

# The Role of Epineurotomy in Carpal Tunnel Syndrome

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## **Abstract:**

**Aim:** The purpose of this study is to compare the effect of epineurotomy of median nerve with just division of the transverse carpal ligament in the treatment of carpal tunnel syndrome.

**Patients & Methods:** We conducted a prospective, random study to evaluate the effect of epineurotomy on the outcome of operative treatment of established median-nerve compression in the carpal canal. Fifty hands (forty-four patients) were selected randomly into two groups: group I had a release of the transverse carpal ligament alone, and group II had a release and adjuvant epineurotomy of the median nerve. The groups were similar with regard to age group, gender, duration of symptoms, and preoperative physical findings. All patients had electrophysiological evidence of sensory delays and fibrillations on preoperative testing.

**Results:** The patients were evaluated perioperatively and postoperatively after 6 months. The results show (60%) in group I and (56%) in group II who no longer had any symptoms referable to the dysfunction of the median nerve. On physical examination, the average two-point discrimination was 5.1mm in group I, and 4.7mm in group II. The electrophysiological tests revealed an average sensory latency 4.1msec in both groups. The follow-up examination revealed no detectable differences between the two groups with regard to symptoms, objective findings, or electrophysiological findings.

**Conclusions:** we conclude that the epineurotomy of the median nerve offers no benefit compared with sectioning of the transverse carpal ligament alone.

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## **Introduction:**

Carpal tunnel syndrome (C.T.S.) is the most common, most important, best defined and the most carefully studied of all nerve entrapment syndromes<sup>1</sup>. It is defined as compression of the median nerve within the confines of the carpal tunnel which is created by the transverse carpal ligament and the carpal bones, characterized by pain and paraesthesia in the sensory distribution of median nerve in the hand, which is most frequently nocturnal.

Carpal tunnel syndrome was first recognized by Sir-James Paget in 1854 who described median nerve compression after wrist trauma. It was estimated that the incidence of CTS is about 400.000-500.000 cases annually in the United States<sup>2</sup>.

The syndrome occurs in adults of any age, but most often in those 30 to 60 years of age. Its occurrence in childhood is rare. It is five times more common in females than males, and occurs more frequently in the dominant hand though both hands are often involved<sup>3</sup>.

The syndrome results from compression of the median nerve within the carpal tunnel. Any condition which reduces the

capacity of the carpal tunnel may compress the median nerve and so cause the syndrome; the commonest cause is swelling or thickening of the flexor tenosynovium<sup>4</sup>.

Surgical treatment is indicated in about 40% of patients with this syndrome. Although the procedure is regarded as a simple one, there are complications which can lead to disability for greater than the original complaint<sup>5</sup>.

### **Patients and Methods:**

From January 2006 to April 2008, 68 hands (seventy two patients) that were

treated operatively at orthopedic department of Al-Ramadi General Hospital. Fifty hands (44 patients) suitable for our study the criteria for inclusion were clinical signs and symptoms of dysfunction of the median nerve due to compressive in the carpal canal that were not responsive to non-operative treatment as well as an electrophysiological studies that demonstrated nerve compression. Cases that are excluded from our study are shown in table (1).

***Table (1) cases excluded from the study:***

<b>Case</b>	<b>No. of patient</b>
<b>1. age below 25 years</b>	<b>4</b>
<b>2. pt. with previous C.T. release</b>	<b>6</b>
<b>3. incomplete follow – up</b>	<b>4</b>
<b>4. insufficient data</b>	<b>3</b>
<b>Pregnant women</b>	<b>1</b>
<b>Total</b>	<b>18</b>

The hands were randomly chosen to receive one type of two treatments: operative decompression of the median nerve by longitudinal incision of transverse carpal ligament alone (Group I) or operative decompression of the median nerve and longitudinal opening of the epineurium in the region of the carpal canal (Group II).

Twenty-five hands were randomly selected for an epineurotomy and other twenty-five, treated without an epineurotomy because each hand was considered separately with no regard for which procedure (if any) was done on the contralateral side, some patients who had symptoms in both hands had the same procedure performed on both and some had an epineurotomy on one side but not on the other. The patients were evaluated six months postoperatively by an Orthopaedic surgeon who has no previous knowledge about our treatment. In addition, all of the patients had an electrophysiological study performed,

both preoperatively and at six months postoperatively, by an independent physician, who also has no previous knowledge about the treatment.

***Group I (no epineurotomy):*** There were fourteen women and eight men, who are 48.7 years in average (range 25-60years). Associated medical conditions include hypertension (three patients), diabetes mellitus (two patients), and arteriosclerotic cardiovascular disease (one patient).

Nineteen hands had pain, altered sensibility, paraesthesia, and loss of manual dexterity, and the remaining six hands had three of the four symptoms. The average duration of symptoms was 2.3 years (range, three months to fourteen years). The minimum duration of follow-up was six months (range, six to twelve months).

***Group II (epineurotomy):*** There were thirteen women and nine men with an average age of 49 years (range, twenty-five to sixty-seven). Four patients also had

hypertension, one had arteriosclerotic cardiovascular disease. Fifteen hands had pain, altered sensibility, paraesthesia, and loss of manual dexterity, and ten hands had three of the four symptoms. The average duration of symptoms was three years (range, three months to ten years). The average duration of follow-up was eight months (range, six to twelve months).

The preoperative physical examination of group I: the average *two-point discrimination* (as measured with static two-point-discrimination techniques) in the distribution of the median nerve was 7.0 millimeters (range, three to more than fifteen millimeters). Tapping over the median nerve at the wrist elicited the *Tinel sign* in sixteen hands (64%) and the *phalen maneuver* of flexing the wrist for a

period of one minute elicited symptoms in fifteen hands (60%).

The preoperative *electrophysiological testing* revealed an average distal sensory latency of 5.1 milliseconds (range, 4.1 milliseconds to no response).

In group II: The average *two-point discrimination* in the distribution of the median nerve was 6.9 millimeters (range, three to more than twelve millimeters). The *Tinel sign* was elicited symptoms in seventeen hands 68% while *phalen test* in 60%.

The preoperative *electrophysiological testing* revealed an average distal sensory latency of 5.2 milliseconds (range, 4.0 msec. to no response). Preoperative electromyography revealed fibrillations in the abductor pollicis brevis and opponens pollicis muscles (table2).

**Table (2): preoperative results:**

	<b>Two-point discrimination</b>	<b>Tinel sign</b>	<b>Phalen test</b>	<b>EMG &amp; NCS</b>
<b>Group I</b>	<b>7.0mm</b>	<b>64%</b>	<b>60%</b>	<b>5.1msec</b>
<b>Group II</b>	<b>6.9mm</b>	<b>68%</b>	<b>60%</b>	<b>5.2msec</b>

#### Operative Technique: 6

All of the operative procedures were performed on an inpatient basis with general anesthesia. All of the procedures were performed by the same surgeon with use of a standardized operative technique under tourniquet control. The incision was made in the hypothenar area just ulnar to the mid-palmar crease, with an attempt made to preserve the palmaris brevis muscle whenever possible. The distal edge of the transverse carpal ligament was identified and divided longitudinally.

At this point, if the hand had been randomized to Group I, the wound was copiously irrigated with sterile saline solution and only the skin was sutured. A

standardized postoperative dressing with compression bandage was applied.

If the hand had been randomized to Group II, small amount of normal saline (1cc) was injected with a fine needle (syringe of insulin) into and around the epineurium to aid its separation, gentle handling and incision by fine curved scissor to expose the nerve proper. When the epineurium is thick and tough, it can very easily be peeled aside, retracted laterally from the line of the incision, and held with fine hemostats. The wound closure and the postoperative dressing were the same as those for Group I.

*Follow-up:* The dressing was removed ten days postoperatively, at which time the patient was told to use the hand as pain

permits. The patient was seen again at one week, six weeks, and six months postoperatively. An analysis of the symptoms, as well as of objective findings compared with those seen preoperatively, was conducted by a surgeon who was blinded with regard to the type of operative treatment. Six months postoperatively, all patients had a repeat electrophysiological test performed by a physician who was also blinded with regard to the operative treatment.

### **Results:**

At six-month follow-up evaluation, fifteen hands (60%) in Group I and fourteen hands (56%) in Group II no longer had any symptoms referable to the dysfunction of the median nerve. With the numbers available for the study we could not show this difference to be significant. On physical examination, the average two-point discrimination in the distribution of the median nerve was 5.1

millimeters (range, three to eleven millimeters) in Group 1 and 4.7 millimeters (range, three to ten millimeters) in Group 2 this difference could not be shown to be significant. Six hands (24%) in Group I and eleven hands (44%) in Group II had a positive Tinel sign. The phalen maneuver elicited symptoms in two hands (8%) in Group I and in four hands (16%) in Group II. Again, these differences were not shown to be significant.

The six-month results of the electrophysiological tests revealed an average sensory latency of 4.1 milliseconds (range, 3.4 to 5.0 milliseconds) for the twenty-four hands in Group I for which it could be measured, as compared with 4.1 milliseconds (range, 3.2 to 5.3 milliseconds) in Group II. Only one hand (4%) in Group I still had unmeasurable latency, whereas none of the hands in Group II did this. Difference was not shown to be significant (table 3).

***Table (3): Postoperative Results***

	<b>Symptom free</b>	<b>Two-point discrimination</b>	<b>Tinel sign</b>	<b>Phalen test</b>	<b>EMG &amp; NCS</b>
<b>Group I</b>	<b>60%</b>	<b>5.1mm</b>	<b>24%</b>	<b>8%</b>	<b>4.1 msec.</b>
<b>Group II</b>	<b>56%</b>	<b>4.7mm</b>	<b>44%</b>	<b>16%</b>	<b>4.1 msec.</b>

We detected no significant difference between the outcome for the hands treated with division of the transverse carpal ligament alone and that of the hands that had adjuvant epineurotomy of the median nerve.

The test showed no significant differences between the two groups at six months ( $P > 0.05$ ), and chi-square analysis showed that the proportions in Groups 1 & 2 were not independent of each other at six months.

### **Discussion:**

The classification of peripheral nerve injuries into neurotmesis, axonotmesis, and neuropraxia (Seddon)<sup>7</sup>, is generally accepted, but neuropraxia has many different causes and a conduction block produced by compression may vary considerably with the magnitude and duration of the deforming force. Category 1, as classified by Sunderland<sup>8</sup> is a temporary conduction block with immediate recovery after removal of pressure, it is almost equivalent to Seddon's neuropraxia. A long existing conduction block which recovers after decompression of nerve fibres fits Sunderland categories 2 and 3.

On the other hand, there is the concept of axonostenosis is proposed by Braun's<sup>9</sup> and based on electrical studies. He assumed that dysfunction of the neural axon was limited to the actual site of compression of axons in continuity. Similar evidence was obtained from our Electrodiagnostic studies on median nerve palsy, in which there was a delay of conduction velocity only at the zone of compression caused by fibrosis.

Several authors have addressed the issue of nerve manipulation, especially epineurotomy, in relation to the outcome of decompression of the median nerve in the carpal canal. Duncan et al<sup>10</sup> found that 369 (79%) of the total number 467 who completed the survey performed a linear epineurotomy through the constricted area of the median nerve during carpal tunnel release.

Robert et al;<sup>11</sup> performed a prospective clinical study of thirty-six wrists (thirty-three patients) that had been randomized to operative treatment of carpal tunnel syndrome with or without an epineurotomy. The patients were evaluated preoperatively and at six or twelve months postoperatively, with fifteen evaluated at both postoperative time-points. Sensory testing showed over-all improvement postoperatively in both groups. The conclusion of that study and ours was that the addition of an adjuvant epineurotomy, although safe, is of no clinical benefit. The study of Robert et al;<sup>11</sup> differed from ours in that not all of the patients had electromyographic changes indicative of denervation of the thenar muscles. However, in both studies, epineurotomy did not cause any significant difference in the outcome of treatment of primary carpal tunnel syndrome.

A recent study involving volumetric measurements and magnetic resonance imaging showed the changes in the carpal tunnel and in Guyon's canal caused by carpal tunnel release. A 24 per cent increase in the volume of the carpal canal following carpal tunnel release was observed, and a consistent change in shape (from oval to circular) took place because of an increase in the anteroposterior dimension. A smaller increase in the mediolateral dimension was also seen. The median nerve displaced palmarly an average of 3.5 millimeters and Guyon's canal increased in size and changed from triangular to oval. As the importance of the 3.5 millimeters of anterior displacement of the median nerve and flexor tendons has not been determined, reconstruction of the transverse carpal ligament is not currently recommended<sup>12</sup>.

Curtis and Eversmann<sup>13</sup> found that internal neurolysis resulted in a return of sensation and improvement in thenar function in patients who had a constant sensory loss and atrophy or palsy of thenar muscles.

However, Gelberman et al;<sup>14</sup> found no significant difference in outcome between patients who had an epineurotomy and those who had not. During our work, we didn't face any post operative complications regarding carpal tunnel release only or with epineurotomy apart from postoperative pain which occurred in one patient from our total number of 50 patients, and he was from the group of carpal tunnel release only. Thus we do agree with Gelberman who reported that there is no difference between both procedures.

### **Conclusion:**

We concluded that:

1. There is no difference in outcome when an adjuvant epineurotomy is performed compared with when a ligament release is performed alone for the advanced forms of carpal tunnel syndrome.
2. A gain of muscle strength after operative decompression of the carpal canal is possible, although such a gain may not be evident for at least six months after the treatment of an advanced lesion.

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