

Evaluation of Findings in Carpal Tunnel Syndrome during Surgery in Patients Referred to Reconstructive Surgery Ward

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Article information	Abstract
<p>Article history: Received: 26 Apr 2013 Accepted: 29 May 2013 Available online: 14 Sep 2013 ZJRMS 2015 Jan; 17(1): 34-36</p> <p>Keywords: Carpal tunnel syndrome Median nerve Electrophysiologic changes Anatomic changes</p>	<p>Background: Carpal tunnel syndrome (CTS) is the most common focal mono-neuropathy of median nerve in carpal tunnel. Prevalence is 2.7-5.8% and is more common in female than male. The most important diagnostic method is electrophysiologic study of median nerve.</p> <p>Materials and Methods: This case-control study has done on 34 patients with CTS and 44 healthy cases underwent electrophysiologic study. The diameter of nerve was measured at site of compression and also at a more proximal site in patients.</p> <p>Results: In CTS group increased significant distal latency in motor and sensory conduction and proximal motor latency of median nerve was noticed. The altitude of sensory median nerve and conduction velocity of median nerve in CTS group was decreased significantly. Thenar atrophy was seen without relation with severity of nerve compression. The nerve diameter was decreased in severe cases of CTS group without significant differences.</p> <p>Conclusion: In CTS severity of anatomic changes are not the same as changes in electrophysiologic study.</p> <p>Copyright © 2015 Zahedan University of Medical Sciences. All rights reserved.</p>

Introduction

Carpal tunnel syndrome (CTS) is one of the most common focal mono-neuropathies caused by the compression of the median nerve in the carpal tunnel. Median nerve is composed of the medial and lateral cords of the brachial plexus [1, 2], approximately inflicting 10% of adult females and 1% of males [3]. The cause of illness is often unknown [4]. The main complaint of CTS patients is superficial sensory impairment surfacing as paresthesia, especially during the nights, which may bring about sleep disorder. The pain may reach the elbow and even shoulders. The numbness may occur in the volar plate of the thumb, index, and long fingers as well as the radial half of the ring finger. Atrophy of short abductor muscle of thumb and other muscles maintained by the median nerve are only observed in the severe cases. Final diagnosis is possible through the electrophysiological assessment of the median nerve and observing sensory nerve conduction delay along the wrist [5].

In cases of early diagnosis, CTS can be cured, while, in mild cases, it can be treated by immobilizing the wrist by using night splints [6]. Local steroid injection [7] has proved helpful as well. As much as 37% of the subjects of a study showed improvement using splints [8]. In advanced cases where the sensory impairment is irritating or there is the case of atrophy of short abductor muscle of thumb and the protective treatments are non-responsive, surgery may obviate the symptoms [9]. The present study

concerned itself with the state of the nerves during surgery in rather severe cases.

Materials and Methods

This case-control prospective study was conducted on 34 patients suffering from CTS who referred to the neurology and reconstructive surgery center. Prior to commencing the investigation, the subjects underwent clinical examination and confirmation of diagnosis through nerve conduction velocity test and determining the severity of involvement of below 6 (3rd, 4th, and 5th degrees) according the Canterbury index [10]. The initial examination followed complaints of pain, numbness, and paresthesia along the median nerve. Subjects with 2 positive tests out of the 3 tests of Phalen, Tinel [11], and direct pressure on the median nerve, underwent electrophysiological assessment of the skin at 32-34°C. Subjects without a known cause of illness went through surgical operation.

As control group, 44 healthy subjects with no complaints of pain and paresthesia, who were similar to the experimental group in terms of age and sex, underwent nerve conduction velocity test as well. Patients whose electrodiagnosis included a base for an abnormal finding other than that of the CTS, and also patients suffering from neurologic, metabolic, and/or synovial diseases were excluded from the study (cases with a

known cause of illness) [12]. The data was analyzed using SPSS-20 and also through descriptive statistics, independent *t*-test, and ANOVA. *p*-value of less than 5% was considered significant.

Results

Provided that it was confirmed through electrophysiological assessment, 34 subjects diagnosed with CTS who did not recover despite the application of night splints and administration of non-steroid anti-inflammatory agents went through transverse carpal ligament release surgery and relieving the pressure on the nerve with general anesthesia. The control group of 44 healthy subjects with no complaints of pain and paresthesia were studied in terms of electrophysiological indices. The subjects included 7 males and 27 females. The average age range was 40.3 ± 11.3 years. Higher narrowing of the nerve was observed in older subjects; however, the difference was not significant. Table 1 shows the results of the electrophysiological assessment of the median and ulnar nerves in the experimental group, while, table 2 portrays the results of the electrophysiological assessment of the median and ulnar nerves in the control group. Patients with the clinical symptoms of CTS showed a significantly increased distal

and proximal conduction delay in the motor and sensory functions of the median, along with a significantly decreased conduction velocity and amplitude of the sensory nerve, and with no significant change in the motor amplitude. The present study also assessed the ulnar nerve in the two groups resulting in no significant difference.

The observed atrophy in the clinical examination was not associated with the changes in the electrophysiological findings, except for the fact that increased distal motor conduction delay was not seen in the presence of atrophy. The surrounding tissue biopsy reported fibrosis in all cases, except for one case of synovitis. The narrowing of the median nerve in the carpal tunnel was mild in 4 cases, moderate in 20 cases, and severe in 10 cases. Electrophysiological findings in cases with higher narrowing showed non-significant electrophysiological changes.

Discussion

The findings showed that involvement in females is 4 times the males. Thenar muscle atrophy was seen in more than 25% of the cases. The average age range of the subjects was 40.3 ± 11.3 years.

Table 1. Mean, minimum, median and maximum for different variables relating to nerve conduction study in patients group (N=34)

Variable	Mean±SD	Minimum (m sec)	Median (m sec)	Maximum (m sec)
Dis. Lat. Median (m sec)*	4.882±1.297	3.000	4.500	9.000
Prox. Lat. Median (m sec)*	8.529±2.744	6.000	8.000	23.000
Amp. M. Median (mV)*	6.27±6.73	1.00	5.00	42.00
CV. M. Median (m/sec)*	56.19±15.93	3.00	58.00	76.00
Dis. Lat. S Median (m sec)*	3.742±1.064	2.000	4.000	6.000
Amp. S. Median (mV)*	12.77±6.99	4.00	11.00	31.00
Dis. Lat. M. Ulnar (m sec)*	3.320±0.557	3.000	3.000	5.000
Prox. Lat. M. Ulnar (m sec)*	6.560±0.917	5.000	6.000	9.000
Amp. M. Ulnar (mV)*	10.96±23.86	3.00	4.00	96.00
CV. M. Ulnar (met/sec)*	60.68±13.95	6.00	61.00	79.00
Dis. Lat. S. Ulnar (m sec)*	2.810±0.928	2.000	3.000	6.000
Amp. S. Ulnar (mV)*	15.48±9.73	5.00	11.00	37.00
CV. S. Ulnar (met/sec)*	39.52±9.08	23.00	41.00	58.00

* Dis: distal, Lat: latency, M; motor, S; sensory, Prox: proximal, Amp: amplitude, CV; current velocity, met: meter

Table 2. Mean, minimum, median and maximum for different variables relating to nerve conduction study in control group (N=44)

Variable	Mean±SD	Minimum (m sec)	Median (m sec)	Maximum (m sec)
Dis. Lat. Median (m sec)*	3.705±0.701	3.000	4.000	5
Prox. Lat. Median (m sec)*	6.773±1.179	3.000	7.000	9
Amp. M. Median (mV)*	6.364±2.460	3.000	6.000	14
CV. M. Median (met/sec)*	62.45±8.17	48.00	62.50	84
Dis. Lat. S. Median (m sec)*	3.1364±0.5537	2.0000	3.0000	5
Amp. S. Median (mV)*	17.18±7.64	5.00	17.00	36
Dis. Lat. M. Ulnar (m sec)*	3.2558±0.4415	3.0000	3.0000	4
Prox. Lat. M. Ulnar (m sec)*	6.581±0.823	5.000	7.000	9
Amp. M. Ulnar (mV)*	7.56±14.90	3.00	4.00	95
CV. M. Ulnar (met/sec)*	63.14±13.31	7.00	63.00	99
Dis. S. Ulnar (m sec)*	2.5897±0.4983	2.0000	3.0000	3
Amp. S. Ulnar (mV)*	18.49±10.76	6.00	16.00	53
CV. S. Ulnar (met/sec)*	45.23±11.42	5.00	50.00	58

* Dis: distal, Lat: latency, M; motor, S; sensory, Prox: proximal, Amp: amplitude, CV; current velocity, met: meter

Motor nerve conduction velocity of the median nerve in the experimental group was significantly lower than that of the control group, but it was within the normal value range of the median nerve conduction velocity. The experimental group showed a higher distal sensorimotor conduction delay as well as the proximal motor conduction delay compared to the control group. The amplitude of the median sensory nerve decreased in the experimental group. The biopsy results of all but one case reported fibrosis.

The average age range of the subjects in the present study was lower than that of other studies [3]. The involvement ratio in terms of sex was similar to that reported in the studies conducted by Wright and Mondelli et al. [2, 3]. The same difference was also reported in another study done in the Iranian society [13]. Higher incidence in females may have been caused by the anatomical structure of the wrist as well as higher activity of the upper extremities in women [14]. The study by Mondelli et al. introduces the sixth decade as the most common incidence age of CTS [3]. The age difference in this study is probably due to more activity in youth, especially house wives. Thenar muscle atrophy is often associated with the severe cases concerning the median nerve narrowing. Decreased motor conduction velocity of the median nerve, heightened distal sensorimotor as well as proximal motor conduction delay and decreased sensory amplitude of the median nerve, all count as specifications of patients suffering from CTS, which conforms to the results from several studies including that of Gluss and Ring [15]. In cases the narrowing of median nerve due to nerve damage were more, the electrophysiological changes were higher. The mentioned changes, however, were not significant. It can be

concluded that the physiological disorder of the median nerve is not as severe as the anatomical changes, and the severity of electrophysiological changes do not represent anatomical changes. The biopsy results of all but one case reported fibrosis, which conforms to the results from the study by Ettema et al. [12].

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Authors' Contributions

Sadollah Samadi was the project director. Electrophysiological assessment was conducted and prepared by Hosseinali Ebrahimi. This study could not be completed without the help of Narges Khanjani as the statistical analyzer and Fardideddin Ebrahimi as project director assistant.

Conflict of Interest

The authors declare no conflict of interest.

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