

The effect of steroid injection by Novel method in carpal tunnel syndrome on pain severity and electrophysiological findings

Karpal tünel sendromunda Novel metoduyla yapılan steroid enjeksiyonunun ağrı şiddeti ve elektrofizyolojik bulgular üzerine etkisi

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ABSTRACT

Objective: The aim of the present study is to investigate the effects of local steroid injection therapy with the Novel method on subjective patient complaints and electrophysiological investigations at the end of 3 months.

Methods: 101 hands of 59 subjects (5 men and 54 women) with mild carpal tunnel syndrome received steroid injection with the Novel technique. Visual Analogue Scale (VAS) was used to determine the severity of pain. Nerve conduction findings obtained prior to and 3 months after the injection were compared using the VAS.

Results: According to the VAS, mean pain severity for the right hand (n:56) was 7.79 ± 1.4 before the injection, and 3.29 ± 1.9 at 3 months. Mean pain severity for the left hand (n=45) was 7.71 ± 1.2 before the injection, and 3.16 ± 2.0 at 3 months. Median motor nerve distal latency was statistically significant for both hands after the injection ($p < 0.001$). Median motor velocity was statistically non-significant in both hands after the injection. After the injection, median sensory distal latency, amplitude and velocity were statistically significant for both hands.

Conclusion: The present study showed the efficacy of local steroid injection therapy on subjective complaints and electrophysiological findings in mild carpal tunnel syndrome. Because the improvement is greater in the non-dominant hand compared to the other, splints should be used to keep the hand in neutral position and hand rest should be employed in addition to the local injection.

Key words: Carpal tunnel syndrome, Novel method, steroid injection, pain severity, nerve conduction studies

ÖZET

Amaç: Bu çalışmadaki amacımız Novel metodu ile yapılan lokal steroid enjeksiyon tedavisini hastanın subjektif şikayetleri ile elektrofizyolojik çalışmalar üzerine olan etkilerinin 3 ay sonra incelenmesidir.

Yöntemler: Hafif düzeyde karpal tünel sendromu olan, 5 erkek ve 54 kadın olmak üzere toplam 59 kişide ve 101 elden Novel tekniği ile steroid enjeksiyonu yapıldı. Ağrı şiddetini belirlemek için görsel analog skalası (Visual Analogue Scale) (VAS) uygulandı. VAS ile sinir ileti bulguları enjeksiyon öncesi ve 3 ay sonrası karşılaştırıldı.

Bulgular: VAS'a göre sağ el (n:56) enjeksiyon öncesi ortalama ağrı şiddeti 7.79 ± 1.4 3 ay sonrası 3.29 ± 1.9 . Sol el (n:45) enjeksiyon öncesi ortalama ağrı şiddeti 7.71 ± 1.2 3 ay sonrası 3.16 ± 2.0 idi. Enjeksiyon sonrası, her iki elde median motor sinir distal latansı istatistiksel olarak anlamlı bulundu ($p < 0.001$). Enjeksiyon sonrası her iki elde median motor hızları istatistiksel olarak anlamsızdı. Enjeksiyon sonrası, her iki elde median duysal distal latansı, amplitüd ve hızı istatistiksel olarak anlamlı bulundu.

Sonuçlar: Bizim çalışmamız gösterdi ki hafif şiddetteki karpal tünel sendromunda lokal kortikosteroid enjeksiyon tedavisi subjektif yakınmalar ve elektrofizyolojik bulgular üzerine etkilidir. Non-dominant elde düzelme, diğer ele göre daha fazla olduğundan dolayı lokal enjeksiyon ile beraber eli nötral pozisyonda tutacak splintler kullanılmalı ve el istirahati yapılmalıdır.

Anahtar kelimeler: Karpal tünel sendromu, Novel metod, steroid enjeksiyonu, ağrı şiddeti, sinir ileti çalışmaları

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INTRODUCTION

Carpal tunnel syndrome (CTS) is the most common trap neuropathy [1]. It has a prevalence of 2.7-5.8%. It is more common among women and usually bilateral. The reason is generally unknown. It may be associated with obesity, pregnancy, arthritis, hypothyroidism, diabetes mellitus, trauma and various cancers. It may cause pain, numbness, tingling and burning particularly increasing at night [2]. CTS may be mild, moderate or severe. Clinical symptoms and abnormal electrophysiological findings may be seen in CTS. Treatment of CTS varies depending on severity of the condition. In mild CTS, wrist splinter, oral corticosteroids and local corticosteroid administration may be used as conservative treatment for 6 weeks to 3 months. Cases without benefit from therapy and moderate-severe CTS should be referred to surgery. No benefit has been shown with nonsteroid anti-inflammatory drugs, diuretics and vitamin B6 [3,4]. The preferred method for local steroid therapy is to inject the local corticosteroid through retina flexorum to carpal tunnel. The dose of the steroid does not alter symptom severity, and studies have shown no effect associated with the type of the steroid [5].

The main objective of this study is to investigate the effects of local steroid injection therapy with the Novel method on subjective patient complaints and electrophysiological investigations at the end of 3 months.

METHODS

The study has been conducted from 2012 to 2013 in a total of 59 subjects (5 men and 54 women) with mild carpal tunnel syndrome (maximum duration of complaints: one year, absence of thenar muscle atrophy and weakness, absence of denervation in electromyography, mild effects on nerve conduction). Mean age was 48.9 ± 12.1 years among the subjects. In this study, patients with evidence of pronounced abductor pollicis weakness or significant thenar wasting, prior carpal tunnel surgery on affected side, use of narcotic analgesia, history of wrist or hand fracture on the symptomatic limb, current pregnancy or less than 3 months postpartum, corticosteroid injection into the carpal tunnel within 3 months, severe and mild carpal tunnel syndrome were excluded.

Visual Analogue Scale (VAS) was used to determine the severity of pain (5). It is usually a line of 10 cm, either horizontal or vertical, from "No Pain" to "Unbearable Pain". According to this scale, 0: no pain, 1-3: mild pain, 4-6: moderate pain, 7-10 severe pain.

Nerve conduction studies were performed according to the American Association of Electrodiagnostic Medicine guidelines with a Medelec Teca Premierie Plus vE05 electromyograph (Surrey, UK) in all cases by the same person (6). Sensory nerve action potentials were assessed as antidromic. Motor nerve action potentials were assessed as orthodromic. Motor sweep speed was 5 msec/div (1-20). Sensory sweep speed was 1 msec/div (2-20). Sensitivity adjustment was 20 uV/mm. Superficial electrodes were used for motor measurements, and ring electrodes for sensory measurements. The region 6-7 cm proximal to the abductor pollicis brevis muscle was stimulated for the median motor nerve measurement while the 2nd finger was stimulated for the median sensory nerve, and the 4th finger was stimulated for the median and ulnar sensory nerves at the same distance. Baseline values to diagnose carpal tunnel syndrome were; median motor nerve distal latency greater than 4 ms, median sensory nerve distal latency greater than 3 ms, a difference greater than 0.5 ms between the distal latencies of median and ulnar sensory nerves from the 4th finger, a velocity less than 50 mm/s for the median sensory and motor nerves. It was ensured to keep the temperature at 34 °C and above for the extremity used for the measurement.

Betamethasone dipropionate (equivalent to 5.0 mg betamethasone), 6.43 mg betamethasone sodium phosphate (equivalent to 2.0 mg betamethasone), 2.63 mg (Diprospan amp©) was used as local injection. Injection was administered using a 25-gauge needle with the technique known as the Novel Method at 2 cm distal to the prominences of thenar and hypothenar muscles. VAS values of the patients and nerve conduction studies were re-evaluated at 3 months.

Statistical Analysis

The Statistical Package for the Social Sciences for Windows 20.0 (SPSS, Inc., Chicago, Illinois) software was used in the analysis of the data. Pain sever-

ity on VAS and nerve conduction studies conducted before and after the injection were compared. Data were subjected to Pearson's chi-square and independent sample T tests. Statistical hypotheses were tested using $p < 0.05$ as the level of statistical significance. Results are expressed as mean \pm standard deviation.

RESULTS

45 of the fifty nine patients had bilateral CTS while 12 had CTS on right hand and 2 had CTS on left hand. According to the VAS, pre-injection pain severity was 3-9 for the right hand. 3.6% of the patients had mild pain while 9% had moderate pain and 87.5% had severe pain. Pain severity was 5-9

for the left hand. 13.4% of the patients had moderate pain while 86.6% suffered from severe pain. None of the patients had mild pain. Post-injection pain severity was 1-9 for the right hand. The pain was mild for 66% of the patients, moderate for 26.8%, and severe for 7.2%. Pain severity was 1-8 for the left hand. 71.1% was mild, 17.8% was moderate, and 11.1% was severe (Table 1).

Median motor nerve distal latency was statistically significant for both hands after the injection ($p < 0.001$). Median motor velocity was statistically non-significant in both hands after the injection. After the injection, median sensory distal latency, amplitude and velocity were statistically significant for both hands ($p < 0.001$) (Table 2, Table 3).

Table 1. Pre- and post-injection values for pain severity on visual analogue scores

Number of patients (n=101)	Pre-injection	Post-injection	p
Right hand (n=56)	7.79 \pm 1.4	3.29 \pm 1.9	<0.001
Left hand (n=45)	7.71 \pm 1.2	3.16 \pm 2.0	<0.001

Table 2. Pre- and post-injection nerve conduction studies on right hand (mean \pm standard deviation)

Right hand (n=56)	Pre-injection	Post-injection	p
Median motor nerve mean distal latency (ms)	4.12 \pm 0.78	3.93 \pm 0.66	<0.001
Median motor nerve mean velocity (m/s)	57.3 \pm 4.55	56.4 \pm 3.84	0.121
Median sensory nerve mean distal latency (ms)	3.32 \pm 0.57	3.19 \pm 0.52	0.003
Median sensory nerve mean amplitude (μ V)	15.6 \pm 7.22	17.7 \pm 6.22	<0.001
Median sensory nerve mean velocity (m/s)	44.2 \pm 7.1	46.2 \pm 6.9	<0.001

*SD: Std. Deviation

Table 3. Pre- and post-injection nerve conduction studies on left hand (mean \pm standard deviation)

Left hand (n=45)	Pre-injection	Post-injection	p
Median motor nerve mean distal latency (ms)	4.39 \pm 0.86	4.15 \pm 0.87	<0.001
Median motor nerve mean velocity (m/s)	57.4 \pm 4.25	55.9 \pm 4.46	0.069
Median sensory nerve mean distal latency (ms)	3.44 \pm 0.69	3.20 \pm 0.57	<0.001
Median sensory nerve mean amplitude (μ V)	16.5 \pm 8.93	18.9 \pm 7.83	<0.001
Median sensory nerve mean velocity (m/s)	43.2 \pm 7.57	46.4 \pm 7.84	<0.001

DISCUSSION

We detected decreased pain severity and neural improvement following steroid injection using the Novel method in patients with CTS.

Several studies have shown that local corticosteroid injections can be used for the treatment of mild or moderate carpal tunnel syndrome. It may be used only before surgery in severe cases [7,8].

Patients with mild CTS were included in the present study. Visual Analogue Scale (VAS) was used to evaluate pain severity. For the assessment of pain severity, VAS was considered an appropriate method at the end of comparative evaluations with other methods. Patients over the age of 5 years have defined this method as 'easy to understand' and 'easy to use'. A regular distribution is used in VAS assessments. Compared to verbal pain assessment,

it offers adequate sensitivity to determine treatment effects. It can be repeated prior to measurement. VAS has become a successful method for assessment in several studies to determine treatment effects. Evaluations have been made with intervals of 1 month and longer following the injection in various studies [9,10].

Hagebeuk et al. [11] used local injection with the proximal approach and found an improvement rate of 43% during the assessment at 1 month. Rukken et al. [12] used diprospan (6.43 mg betamethasone dipropionate 2.63 mg betamethasone sodium phosphate ampule) in 20 hands of 16 patients, and observed significant improvement at 3 months according to Boston Symptom Severity Scale.

We performed VAS assessment in the beginning and 3 months after the injection. Following the injection, similar and notable improvement has been observed in subjective pain severity in both hands. The improvement rate was 57.8 in the right hand, and was 59.0% in the left hand. Significant improvement was observed in distal latency, amplitude and velocity of the median sensory nerve during nerve conduction studies after the injection while it was observed only in distal latency of the median motor nerve.

Padua et al. [13] showed the correlation between the symptoms leading to clinical presentation and electrophysiological parameters, and demonstrated improvement in both parameters after local injection. Similar reports have been reported by Dhong et al. [14], as well as Dudley Porras et al. [15]. However, Mondelli et al. [16] and Demirci et al. [17] did not show an association between the two parameters. BCTQ scale was used for subjective pain assessment in these reports. Using different scales for assessment may be associated with different injection sites and different pharmacological agents.

The advantage of local steroid injection compared to other medical treatments is the use of single administration. The disadvantage is the problems associated to the invasive procedure. Median nerve damage is the most important complication among these problems. In this study, abscess developed at 4 cm proximal to the injection site in one of the patients.

Different approaches are used for the injection. The most commonly used technique is the classic approach. It is administered above the transversal ligament of the wrist and on the ulnar side of palmaris longus tendon. In this study, local injection was administered to the patient using the Novel approach method [18]. Median nerve is less likely to be damaged as it is located in a deeper and lower level compared to the injection site. None of the patients included in the present study developed nerve damage.

Efficacy of local injection therapy has been shown in long-term studies. Visser and colleagues demonstrated improvement in half of the patients they evaluated in a period longer than 15 months [7].

Badarny et al. [19] used the Novel method for local injection, and showed the efficacy on symptoms of the patients and electrophysiological findings. Although the present study covered a period of 3 months, it correlated with the other studies. We found significant neural improvement in our patients. Another important finding of the present study was the greater improvement in the non-dominant left hand compared to the other. This was probably attributable to the pressure effect on median nerve due to more profound use of the dominant hand during the three months following injection.

The advantages of novel approach according to studies using the classic approach is reliable, simplicity, quickness, convenience for both patient and doctor, and far less pain severity, all of which enable even general practitioners to use this approach after observing it once or twice [18,19].

The present study showed the efficacy of local steroid injection therapy on subjective complaints and electrophysiological findings in mild carpal tunnel syndrome. Because the improvement is greater in the non-dominant hand compared to the other, splints should be used to keep the hand in neutral position and hand rest should be employed in addition to the local injection.

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