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Evaluation of the Effect of Local Corticosteroid Injection and Anti-inflammatory Medication in Carpal Tunnel Syndrome

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Abstract

Background and Aims

To evaluate the effect of local corticosteroid injection versus non-steroidal anti-inflammatory drugs (NSAIDs) in the treatment of carpal tunnel syndrome (CTS), 32 patients were included in this study.

Methods

A prospective, randomised clinical trial, assessing functional findings by Functional Status Scale (FSS), Jebsen Taylor Test (JTT) and electrophysiologic examinations, analysed on initial visit and at the third month after treatment. Group A was treated with betamethasone injection and group B with NSAIDs, both with concomitant use of wrist splints.

Results

The mean age of the patients was 40.8 ± 11.2 (range 21-64) years. There was a significant improvement in FSS in groups A and B at the third month. In JTT, 'writing', 'picking up small common objects' and 'picking up large heavy objects' activities were improved in group A; 'writing' and 'stacking checkers' activities were improved in group B. Statistically significant improvement was observed in peak sensory conduction velocity and distal motor latency in groups A and B. Mixed nerve conduction velocity and compound sensory action potential were improved in group A.

Conclusions

The results showed that neither of the groups demonstrated superior results. We conclude that local steroid injection and NSAIDs with concomitant use of wrist splints may offer patients with CTS variable and effective treatment options for the management of functional scores and nerve conduction parameters.

Key Words

Carpal tunnel syndrome, corticosteroid injection, anti-inflammatory medication,
Functional Status Scale, Jebsen Taylor Test.

Introduction

Carpal tunnel syndrome (CTS) is the most common compressive neuropathy of the median nerve in adults older than 30 years, particularly in women.[1,2,3] The important risk factors for development of CTS include female gender, obesity, history of diabetes mellitus, thyroid disease, osteoarthritis and rheumatoid arthritis.[3,4]

Patients complain of paraesthesia involving fingers innervated by the median nerve and a weakness of thumb abduction.[1] There are numerous options in treating CTS including splinting, non-steroidal anti-inflammatory drugs (NSAIDs), local and systemic steroid medications, diuretics and pyridoxine.[1,5] Injection with corticosteroids is one of the many recommended treatments and one of the most studied treatment modalities.[6,7,8,9] The corticosteroids are used as anti-inflammatory medications administered via injection or systemically. NSAIDs are frequently used for controlling symptoms in CTS.[5,10]

In this study, we prospectively assessed the functional and electrophysiologic effectiveness of local corticosteroid injections versus NSAIDs, in conjunction with wrist splint use, in the treatment of CTS.

Materials and Methods

Patients with clinically suspected primary CTS were referred to the electromyography (EMG) laboratory of our hospital. Thirty-two women who were diagnosed with CTS using both clinical and electrodiagnostic findings were enrolled in this prospective, randomised study. All participants were housewives with mild or moderate CTS. The exclusion criteria were as follows: patients with evidence of severe CTS, trauma, peripheral nerve lesion or previous operation for CTS, systemic diseases, pregnancy, and contraindication for steroid use.

Patients were randomised into two groups. The two treatment modalities were distributed evenly in an equal number of envelopes and patients chose treatment protocols by chance. Patients in group A (n=18) were treated with local injection of six mg betamethasone through a 25-gauge needle inserted one centimeter proximal to the distal wrist-flexion crease between the palmaris longus and flexor carpi radialis tendons. The needle was introduced slowly, and the injection was stopped if the patient experienced "pins and needles" sensation or pain in the fingers. If a resistance was felt, the needle was withdrawn a few millimetres and then repositioned.[9]

The injections were performed by the same physician. The patients in group B (n=14) were given NSAIDs (meloxicam 15 mg/day, PO, for three weeks) as medication. All patients in both groups were advised to apply wrist splints in a neutral position at night, also for three weeks. All treatments were stopped at the end of three weeks. The evaluation was made bilaterally, but only the findings of the dominant hand were analysed.

The functional level of the patients was evaluated using the Functional Status Scale (FSS), which consists of eight activities to be completed by the patient.[11] Each question was assessed on a one-point (no complaints) to five-point (very severe or continuous complaints) scoring system. Increased FSS score indicates worsening of the functionality of the hand. FSS scores range between eight-forty.

Jebsen Taylor Test (JTT) was used to evaluate the patient's hand dexterity. This test includes seven daily living activities: writing (J1), turning over cards (J2), picking up small common objects (J3), simulated feedings (J4), stacking checkers (J5), picking up large light objects (J6), and picking up large heavy objects (J7). A chronometer was used to determine the time required for each activity.[12] An adequate explanation of the test was made to the patients by a physician before the test was applied.

Nerve conduction studies were performed by the same physician with a Medelec Synergy (Oxford, UK) electromyograph. Electrophysiological parameters for the diagnosis of CTS were: median nerve peak sensory conduction velocity (DII) below 41.26 m/sec, mixed nerve conduction velocity (at eight centimeters) below 34.05 m/sec and/or recording from abductor pollicis brevis (APB) muscle, a distal motor latency (DML) above 3.6 msec.[13,14] In this study, compound sensory action potential (CSAP) amplitude (μV), DII (m/sec), mixed nerve conduction velocity (m/sec), compound muscle action potential (CMAP) amplitude (mV), DML (msec) and median nerve (wrist-elbow) conduction velocity (m/sec) were evaluated bilaterally, but only the findings of the dominant hand were analysed.

The functional and electrophysiological investigations were made at baseline and at the third month of the study.

Data were analysed with SPSS 13.0 (SPSS Inc., Chicago, IL, USA) software. Descriptive statistics were given as mean, standard deviation and numbers. Parameter values before treatment and at the third month after treatment were compared with paired samples t test. Differences among the groups were investigated with independent samples t test. The significance level was set at $p < 0.05$.

All procedures were in accordance with the Helsinki Declarations of 1975.

Results

Thirty-two women ranging in age from 21 to 64 years (40.8 ± 11.2) had a duration of symptoms between three to 56 months. Thirty-one patients had CTS on the right hand, and one patient on the left hand. The demographic data of the patients in groups A and B are summarised in Table I.

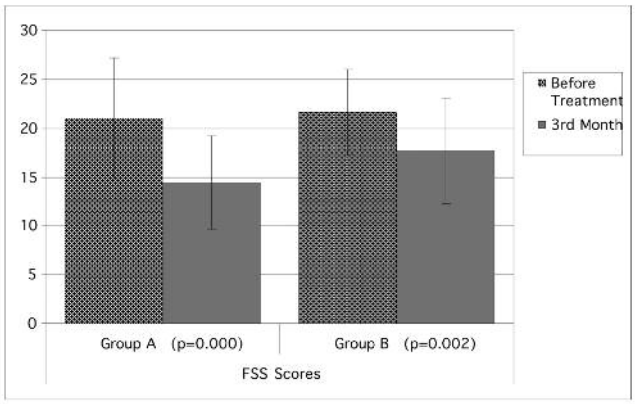
Table I: Summary of Demographic Findings

	Group A (n=18)	Group B (n=14)
Age (year)	39.1±8.0	42.9±8.3
Symptom duration (month)	21.7±8.5	22.0±8.6
Education (year)	7.4±1.8	7.5±1.9

No complications or side effects to treatment were observed in any of the patients at the end of the treatment.

The third month FSS scores were improved in group A (p=0.000) and B compared to pretreatment scores (p=0.002) (Figure 1). No significant difference was found in FSS between groups A and B at the third month (p>0.05).

Figure 1: FSS (Functional Status Scale) Scores before Treatment and at the Third Month



FSS: Functional Status Scale

JTT scores of group A were analysed, comparing baseline and third month results. 'Writing', 'picking up small common objects' and 'picking up large heavy objects' activities were improved in group A (p=0.014, p=0.003, p=0.046 respectively). In group B, the improvement was observed in 'writing' and 'stacking checkers' activities (p=0.004, p=0.040 respectively) (Table II). However, there was no statistically significant difference between groups A and B in JTT items (J1-J7) at the third month (p>0.05).

Table II: JTT Scores before Treatment (Bf T) and at the Third Month

	Group A			Group B		
JTT	**Bf T**	**3rd**	**p**	**Bf T**	**3rd**	**p**
J1	82.0±37.0	69.2±31.3	**0.014**	100.3±54.9	81.7±34.2	**0.004**
J2	15.7±4.7	13.7±3.6	>0.05	18.2±5.0	16.3±6.3	>0.05
J3	6.2±1.3	5.3±0.7	**0.003**	7.3±2.1	6.5±1.1	>0.05
J4	6.8±1.4	6.3±0.9	>0.05	7.5 ±1.3	6.9±1.8	>0.05
J5	3.1±0.3	3.0±0.2	>0.05	3.3±0.4	3.0±0.2	**0.040**
J6	6.8±1.8	5.8±1.1	>0.05	7.4±2.2	6.5±1.5	>0.05
J7	4.8±0.9	4.3±0.6	**0.046**	5.5±1.1	4.8±0.8	>0.05

JTT: Jebsen Taylor Test

When the electrophysiological findings were analysed, the improvement was observed in DII (p=0.001), mixed nerve conduction velocity (p=0.000), CSAP (p=0.020) and DML (p=0.000) in group A. In group B, DII (p=0.009) and DML improved (p=0.002) (Table III). We could find no significant difference between groups A and B according to electrophysiological parameters at the third month (p>0.05).

Discussion

There are various conservative treatment options for CTS, the most common peripheral neuropathy. In a recent review, splinting, activity modification, NSAIDs and steroid injection were indicated as suggested treatments especially for mild to moderate median nerve function.[15]

Table III: Electrophysiological Parameters before Treatment (Bf T) and at the third Month

	Group A			Group B		
	Bf T	3rd	p	Bf T	3rd	p
CSAP (μV)	50.8±17.0	56.5±15.9	**0.020**	44.0±21.9	45.6±19.6	>0.05
D II (m/sec)	30.9±3.8	33.7±2.5	**0.001**	30.8±3.3	32.5±3.2	**0.009**
Mixed nerve conduction velocity (m/sec)	27.7±3.6	31.3±3.3	**0.000**	27.4±3.2	28.9±4.0	>0.05
CMAP (mV)	8.6±2.6	9.3±2.6	>0.05	8.8±3.2	8.6±3.5	>0.05
DML (msec)	4.4±0.6	3.8±0.6	**0.000**	4.3±0.6	3.8±0.5	**0.002**
Median nerve conduction velocity (m/sec)	57.3±3.9	58.0±3.3	>0.05	57.4±4.2	58.2±3.5	>0.05

In this study, we compared two conservative treatment options, both in conjunction with wrist splint application.

There are many studies about the effectiveness of different steroid treatments.[6,7,8,9] Wong et al evaluated the efficacy of oral steroids versus local steroid injections into the carpal tunnel. They found that injections produced better results in the study group.[7] O'Gradaigh et al. compared low- and high-dose and short- and long-acting corticosteroids in the treatment of CTS and found that low-dose corticosteroid is as effective as higher doses and potentially less toxic in short- and long-term follow-up.[8] We used six mg of betamethasone for injections and believe this dose is effective, but in our study we did not compare different doses in the different groups. Gelberman et al, in their study, investigated the role of steroid injection and splinting prospectively. He found that 22% of the hands in his study group were completely symptom-free for more than 12 months. He concluded that the most improved patients were those with mild symptoms, normal thenar strength and mass and with mild prolonged DML.[9] Banta applied a standardised treatment protocol for 23 hands with CTS. Four of 23 hands (17%) responded to wrist splinting plus NSAIDs. The remaining 19 whose treatment failed with this medication were treated with iontophoresis. Iontophoresis of dexamethasone-phosphate was successful in 11 hands (58%) at the sixth month follow-up. In eight of 23 hands (35%), medical treatment failed. These patients were referred for surgical treatment.[16] In a study comparing the efficacy of local corticosteroid injection to NSAIDs and splinting for the treatment of CTS, 33 hands were randomly treated. Clinical (symptom severity scale, visual analog scale, Tinel and Phalen tests) and electromyographic evaluations were improved in both groups after eight weeks.[17] In our study, we found electrophysiologic parameters to be more improved in the patients treated with local steroid injections than NSAIDs. Functional improvements were also recorded in both groups.

Wrist splints applied at night to hold the wrist in neutral flexion are often of benefit in alleviating symptoms. The volume of the carpal tunnel varies with the position of the wrist and is maximal in neutral dorsopalmar flexion range. It is advised that splinting may help up to 75% of the patients, especially in mild to moderate cases.[1,5] In our study, all the patients were advised to use wrist splints, and the results showed improvement both functionally and electrophysiologically. Although the wrist splint seems to be effective, the lack of a control group using wrist splints with either placebo oral medication or placebo injection prevented us from ascertaining the benefit of wrist splint use alone.

These findings led us to conclude that the two treatment methods resulted in some functional gains in hand dexterity and improvement in electrophysiological data, but with neither of the methods demonstrating superiority. Considering the results of our study, we suggest that local steroid injection and NSAIDs, both with concomitant use of wrist splints, are alternative nonoperative therapies and may offer patients with mild to moderate CTS variable, effective treatment options for the management of functional scores and nerve conduction parameters. This topic should be further explored in new studies with appropriate control groups over long-term follow-up periods.

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