

## Comparison Efficacy of Triamcinolone and Wrist Splint in Severe Carpal Tunnel Syndrome in Pregnancy

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### Abstract

**Introduction:** Carpal tunnel syndrome (CTS) is entrapment of median nerve in carpal tunnel of the wrist. The main aim of this study was to compare the effectiveness of steroid injection and wrist splint in severe carpal tunnel syndrome in pregnancy. The cases were selected among pregnant women who referred to OB and GYN clinic in Yasuj city in South- west of Iran.

**Materials and methods:** This study is a randomized clinical trial which was accomplished from December 2010 to June 2012 at S. Mofateh Clinic on 28 pregnant women. Standard electrodiagnostic techniques were performed on the women who had clinical symptoms of CTS in their hands, with positive Tinel and/or Phalen tests, for rule in/or out of CTS. The patients with severe CTS were randomly divided in 2 groups including triamcinolone injection (40 mg) and wrist splint in night for 6 weeks. Electrophysiologic parameters of median and ulnar nerves were recorded before and 2 months after the steroid injection and wrist splint. In cases of observing changes from severe to lower stages of the disease in electrodiagnostic studies, treatment was considered successful and otherwise failed.

**Results:** Effectiveness of triamcinolone injection and wrist splint were 85. 7% and 90. 9%, respectively. There was no significant difference between treatments by steroid injection and wrist splint ( $p=0. 157$ ). Also no correlation was observed between severe carpal tunnel syndrome and number of pregnancy.

**Conclusion:** Triamcinolone injection or wrist splint are effective methods for treatment of severe CTS in pregnancy and therefore recommended instead of carpal tunnel release surgery.

**Keywords:** Carpal tunnel syndrome; Steroid injection; Wrist splint; Pregnancy

### Introduction

Carpal tunnel syndrome is entrapment of median nerve during passing in carp [1]. Carpal tunnel syndrome is the most common entrapment mononeuropathy. Symptoms of carpal tunnel syndrome include paresthesias (numbness, tingling, and burning) involving the median nerve distribution along with a deep aching pain in the hand and wrist [2]. Women are considerably more prone to this syndrome in a ratio of 3:1 to about 10:1 [2]. Obesity and pregnancy are also risk factors for CTS [3]. Alterations in fluid balance may predispose some pregnant women to develop carpal tunnel syndrome. Symptoms are typically bilateral and first noted during the third trimester. Conservative measures are appropriate, because symptoms resolve after delivery in most women with pregnancy-related carpal tunnel syndrome [4]. Carpal tunnel syndrome is a frequent complication of pregnancy, with a prevalence reported as low as (3.4%) [5] to as high as 62% [6]. Based on neurophysiologic findings and American Association of the Electrodiagnostic Medicine (AAEM) is divided in three stages of mild, moderate and severe [7]. The gold standard for diagnosis of CTS is electrodiagnostic studies [8].

The criteria for electro diagnostic of CTS are:

1. A difference of greater than 0.5 ms between the median and ulnar nerve sensory latencies in the same hand;
2. A difference of greater than 1 ms between the median and ulnar motor latencies in the same hand [9].

If the distal latency of sensory nerve action potential between median and ulnar nerves is more than 0.5 ms and if the distal latency of compound muscle action potential between median and ulnar nerves is more than 1 ms, then it is considered as positive test in

electrodiagnostic studies [9]. Treatment of CTS is different based on severity of syndrome. Conservative therapy of CTS consists of patient education, job changes or modification, wrist splinting, B vitamins, non-steroidal anti-inflammatory medication and steroid injection [10]. Carpal tunnel decompression also benefits patients with advanced thenar atrophy and sensory deficits [11]. The main aim of this study was to compare the effectiveness of triamcinolone injection and wrist splint in severe carpal tunnel syndrome in pregnancy.

### Materials and Methods

Twenty eight eligible patients were divided in 2 identical groups, with two treatments: steroid injection and wrist splint. Three women in wrist splint group refused to continue treatment. This research was a randomized clinical trial which was conducted from December 2010 to June 2012. In this research all pregnant women who referred to gynecology clinic were studied. Pregnant women were examined by gynecologist, history was taken, and Tinel and Phalen tests were checked. The women that had clinical symptoms of CTS and positive provocative tests, were referred to physiatrist for electrodiagnostic evaluation.

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Inclusion criterion include women that had paresthesia of hands in duration of pregnancy. Exclusion criteria in this study were diabetes mellitus, collagen vascular disease, renal failure, hypothyroidism, rheumatoid disease, pre-pregnancy CTS, positive family history of neuropathy, carpal tunnel surgery and fracture of wrist bones. After referral to physiatrist, electrodiagnostic evaluation was done for these pregnant cases for evaluation severity of CTS. If pregnant woman had severe CTS, she entered in the research. Then, the patients were randomly placed in one of treatments groups including steroid injection and wrist splint treatments.

The wrist splint was made by Iran Odor Company (Iran). Wrist splint was used at night in neutral position for 6 weeks. Triamcinolone (Triamhexal); made by Holzkirchen factory in Germany, was injected without anesthetic substance and using needle number 23, with 30 degrees angle on radial side of wrist in carpal tunnel. For follow-up the effectiveness level of treatment, electrodiagnostic studies were done two months after treatment. The effectiveness of treatment was described in the manner of change of disease stage from severe to moderate or mild or complete recovery.

Designed forms were used for collecting comprehensive data from patients. The women were explained about entering research and they were given assurance about confidentiality of information and that the studies are riskless for their fetus. Then the women were referred to physiatrist for electrodiagnostic studies, with enclosed forms. In this study, median nerve motor component was stimulated orthodromically and the sensory component antidromically. For evaluation of motor nerve conduction study, stimulating electrode was stimulate at the wrist, 3 centimeter (cm) proximal to the distal crease and recording surface electrode over the belly (G1) and tendon (G2) of the abductor pollicis brevis, whereas the ground electrode was located in the palm. For evaluation of sensory nerve conduction study of median nerve, recording electrode was done on 3<sup>rd</sup> digit with stimulation of sensory median nerve antidromically 14 and 6 cm proximal to G1 electrode. The ground electrode was located in the distal of forearm. For evaluation of motor and sensory conduction study of lunar nerve, the stimulation at the wrist, 3 cm proximal to the distal crease, and recording over the belly (G1) and tendon (G2) of the adductor digiti minimi for motor conduction (8 cm), and around the proximal (G1) and distal (G2) interphalangeal joints of the fifth for antidromic sensory conduction (14 cm) and ground electrode was located in the distal of forearm.

Latency (the time from onset of stimulation until wave appearance or peak of wave) is also important and was determined. Peak-to-peak amplitude was calculated in evaluation of nerve conduction studies. The surface temperature of upper limbs was greater than 32 degree centigrade. Electrodiagnostic studies performed with Medelec machine that manufactured in United Kingdom. The settings of electromyography are as follows: Pulse duration: 0.2 ms, Stimulus speed : 2 ms/division, Sensitivity: 20mic-v/division for sensory, 1v/division for motor, filter settings were 3 Hz to 10 KHz in motor and 10 Hz to 3 KHz in sensory study. Supramaximal intensity was used for stimulation, and obtaining sensory and motor responses. Neurophysiological tests grade the CTS into the mild, moderate, and severe categories, according to the American Association of the Electrodiagnostic Medicine (AAEM) criteria [6]. If we want to precisely compare the level of effectiveness of the applied treatments, we must see how many mounting recovery steps have occurred. It has been in several stages. If it electrodiagnostic changes to moderate after treatment of severity of disease, it is the indication of one step recovery. But if it changes from severe to mild, it indicated two steps of recovery and if it returns to normal, three steps of recovery is indicated. All statistical calculations were performed

using Statistical Package for Social Sciences (SPSS) for window version 10. Unpaired *t* test was used to calculate statistical significance when comparing baseline parameters, improvement in clinical scores and change in electrophysiological parameters between the two groups. *P* value of less than 0.05 was considered significant.

## Results

This study was conducted entitled comparing therapeutic effects of triamcinolone injection and wrist splint in severe carpal tunnel syndrome in pregnancy. In this study 28 pregnant women suffering from severe CTS were selected. Fourteen of them were treated with triamcinolone injection and others with wrist splint. Three of them refused to wear wrist splint. The range age of patients was between 26 to 49 years, and among them the range of 28-31 years had the most frequency. There was not a significant correlation between age and suffering from severe CTS in this study ( $p=0.388$ ). Among the studied women suffering from the severe CTS, 13 cases (52 percent) were in second trimester. Statistically, no significant correlation was observed between suffering from severe CTS in pregnancy with trimesters ( $p=0.621$ ,  $df=1$ ).

All patients were complains of paresthesia in their fingers. In physical examination, neither of women had thenar atrophy. Among the studied women, 5 (20 percent) were suffering in the left hand, 14 (56%) in the right hand and 6 (24%) in both hands. In view of severity of CTS among 50 studied hands, 31 (62%) were suffering from severe CTS, 6 hands (12%) were normal from the beginning. Also among 50 hands, 9 (18%) were in mild CTS and 4 hands (8%) were in moderate stage of CTS. The 32% of women had history of one pregnancy, 20%, two pregnancies and 16% had history of four pregnancies. Based on statistical calculations, there was not a significant correlation between number of pregnancy and suffering from severe CTS ( $p=0.591$ ). Weight did not had a significant correlation with suffering to severe CTS ( $p=0.915$ ).

In group of triamcinolone injection, 28 hands were studied by means of electrodiagnostic study before and after treatment, 4 hands (14%) were normal from the beginning, that is had not difficulty in electrodiagnostic study. The 6 hands had no change occurred in electrodiagnostic study after treatment and had not recovery. The 12 hands had one step recovery and 5 hands had two steps recovery and one hand had three steps of recovery. But in the second group (wrist splint), responses to treatment in 22 studied hands were as follows: two hands were normal from the beginning, 20 hands were suffering from different degrees of CTS, with 15 hands suffering from severe disease and 5 hands had mild degree. In 5 hands no change occurred in the electrodiagnostic studies. There were twelve hands with one step recovery, and the 2 hands with two steps recovery. Similar to group 1, only one hand mounted three steps recovery.

In accordance with statistical calculations,  $p=2.418$  and  $df=3$ , indicating that there is not a significant correlation between the two treatment groups. Also using Monte Carlo test, no significant correlation was found between the two groups ( $p=0.680$ ).

According to the results of another study, in severe cases, changes of electrodiagnostic study to any mild stage of disease after treatment is considered as recovery. Failure of treatment is defined as case in spite of treatment, electrodiagnostic studies after treatment is in severe stage of the disease. Accordingly in the first group, 14 cases were suffering from severe type of disease. The 12 (85.7%) cases recovered, and 2 cases showed failure of treatment. In the second group, among 10 studied cases (90.9%) recovered and failure of treatment occurred in only one

case. In this study, there was not a significant correlation between treatment with steroid injection and wrist splint ( $p=0.157$ ,  $df=1$ ) (Table 1).

	Value	df	Asymptotic significance (2-sided)
Pearson Chi-Square	2.418	3	0.490
Likelihood Ratio	2.627	3	0.453
Fisher's Exact Test	2.643		
Linear-by-Linear Association	0.633	1	0.426
No of Valid Cases	25		

Table 1: Chi-Square Tests.

## Discussion

The objective of this study was to compare therapeutic effects of two methods: steroid injection inside carpal tunnel and wrist splint in the women suffering from severe CTS in pregnancy. Many studies have been conducted on the prevalence of CTS worldwide but little data is available on the effects of different therapeutic methods. In pregnant women the treatment for severe CTS is steroid injection, wrist splint or surgical operation [12]. Splinting the wrist at a neutral angle helps to decrease repetitive flexion and rotation, thereby relieving mild soft tissue swelling or tenosynovitis. Wrist splint is usually worn during night and in case of tolerance it is also worn during days. When worn at night for four weeks, a specially designed wrist brace was found to be more effective than no treatment in relieving the symptoms of carpal tunnel syndrome [13].

Steroid injection to carpal tunnel, is recommended in cases that symptoms last less than three months. In case of severe and progressive weakness of the thenar muscle atrophy and no response to steroid injection treatment or wrist splint, surgical operation must be done. In this study, injection of triamcinolone to carpal tunnel and nightly use of wrist splint by the pregnant women suffering from severe CTS, did not show a statistically significant difference in the recovery of the symptoms of syndrome ( $p=0.157$ ), but each of them have been separately effective.

In study by Kimura, treatment with 40 mg triamcinolone caused complete healing in 35 percent of patients and relative relief in 58 percent of cases [14]. In study of Shalom et al., wrist splint in neutral position was during night, caused reduction of symptoms in 80% of patients [15]. In study of McLennan et al., 67 percent of patients who were treated with wrist splint, lacked symptoms until 30 months after treatment [16]. In study of Dawson, relief of symptoms were reported 45 days after steroid injection in 90 percent of the patients and 6 months after injection in 93 percent of the patients [17]. In study of Mishra, forty patients with CTS were randomly divided into splint group ( $N=20$ ), wearing splint in neutral position for 4 weeks; and steroid group ( $N=20$ ), who received oral prednisolone 20 mg/day for 2 weeks followed by 10 mg/day for 2 weeks. There was significant improvement in both groups, clinically as well as electrophysiologically, at 3 months. On comparing the efficacy of the two treatment methods, except for the functional status score, there was no significant difference between the two groups [18]. We can say that the calculated ratio of effects of steroid injection has a great interval with its ratio calculated 35% in a study by Kimura [14]. The study of Shalom et al. have mentioned the effects of wrist splint 80% [15] which is very close and consistent to the present research. In study of Dawson, have calculated the effects of steroid injection in 90% of the patients [17] which is consistent with the present research and has no much difference. In study of Akalin et al., the effects of wrist splint were 72% and effects of tendon gliding exercise were 93% that no significant difference was observed between the two groups [19].

In study of Lee et al., which was conducted on patients suffering from moderate and severe CTS, triamcinolone was injected on the patients, recovery of symptoms was observed, but electrodiagnostic parameters did not change [20].

In a study by Mishra et al. which was conducted on 40 patients suffering from CTS, one group wore splint and other group received oral steroid. No significant difference was obtained clinically and electro diagnostically between two groups [18].

Our research is consistent to the studies by Mishra et al. [18], Lee [20], Akalin et al. [19], Shalom et al. [15] and Dawson [17], but it is much different from the study by Kimura [14]. If the effectiveness percentage of steroid in Kimura study has been correct, steroid injection must be eliminated from the treatment of CTS. In different studies, the prevalence of CTS is considered to be more in third trimester of pregnancy. In this study also prevalence of severe CTS was more in second and third trimesters. Similar results have been obtained in many studies, including studies by Padua et al. [21], Tupkovic et al. [22] and Turgut et al. [4].

The ratio of suffering from unilateral severe CTS of right hand was 52%, that surplus in comparison to left hand could be because of more use of right hand. Contrary to the study by Yazdanpanah et al. [5], which was conducted to study the prevalence of CTS in pregnant women and others, in this study there was not a significant correlation between number of pregnancies and suffering from severe CTS ( $p=0.591$ ).

## Conclusion

In different studies, it has been proved that prevalence of CTS is more in pregnant women in comparison to others. Therefore, to protect full health of women and their fetus, timely diagnosis of the syndrome and doing needful treatment is necessary. Choosing the best treatment with least complication in the sensitive period of pregnancy is of special importance. Therefore it is obvious in this study that wrist splint as a noninvasive treatment could be used in the best manner. With respect to the high prevalence of the syndrome regular examination of pregnant women especially in the third trimester and in case of suffering from CTS, it could be diagnosed in time and the patients receive appropriate treatment. We hope that effective steps in the field of prevention, early treatment and reducing the complications of the syndrome, will be possible in future.

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