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Research Article

Study of the Outcome of Local Steroid Injection in Carpal Tunnel Syndrome

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Abstract

Introduction

Carpal tunnel syndrome (CTS) is one of the most common compression neuropathies. The optimal treatment of CTS has not been established. Local steroid injection is one of the non-surgical treatment modality that has been found to be very effective in relieving the symptoms in patients of CTS.

Aim

To assess the evidence based outcome of local steroid injection in carpal tunnel syndrome in our perspective.

Materials and Methods

A prospective, interventional and observational study was conducted in 40 patients of CTS. The outcome following local steroid injection was assessed by Boston Carpal Tunnel Questionnaire (BCTQ).

Results

Out of 40, 28 patients (70%) had significant improvement in the symptoms upto last follow-up (i.e 6 months) while 4 patients had recurrence of symptoms at 3 months and 8 patients had recurrence at 6 months. Local steroid injection was repeated in these 12 patients. Six of these patients had improvement in symptoms following re-injection while the other 6 patients didn't improve with re-injection and surgery was advised. The Boston symptoms severity and functional scores showed significant improvement following steroid injection at each follow-up in comparison to scores at the time of presentation (P-Value 0.0001)

Conclusion

Local steroid injection is safe and effective treatment for the relief of symptoms in most of the patients of CTS and should be considered as the first-line therapy.

Introduction

The Carpal tunnel syndrome (CTS) or median nerve palsy is a pathologic condition in which median nerve is compressed at the wrist, leading to pain, paresthesia, numbness and weakness in the median nerve distribution of the hand [1]. It is one of the most common compression neuropathies of upper extremity and accounts for approximately 90% of all entrapment neuropathies. It is usually common in middle-aged individuals with peak age of occurrence from 30 to 60 yrs. and affects females more often than males [2]. The prevalence of CTS in the U.K is 7-16% and in the U.S around 5% [3].

The exact cause and pathogenesis of CTS in majority of patients is not clear but the risk is high in occupations involving exposure to high pressure, high force and repetitive use of vibrating tools. Other factors including metabolic disorders such as diabetes mellitus & thyroid abnormalities, kidney disease, connective tissue disorders, distal radius fractures, pregnancy and obesity may contribute to CTS [4].

The classical symptoms of CTS include nocturnal pain associated with tingling and numbness in the distribution of median nerve in the hand. Thenar muscle weakness or atrophy is a late features and seen in severe form of CTS.

The diagnosis of CTS is mostly clinical. There are several physical examination tests like Phalen's test, Tinel's sign, Katz hand diagram that help in the diagnosis of CTS but none of these tests are diagnostic on their own [5,6]. The nerve conduction study is considered as the gold standard test but it is associated with false positive & false negative results. Therefore the diagnosis of CTS is based on history, physical examination and results of electrophysiological studies [2].

The treatment of CTS includes both non-surgical and surgical methods. Non-surgical options are wrist splinting, nonsteroidal anti-inflammatory drugs and steroid injections.

Although the study regarding the effectiveness of local steroid injection in CTS has been done in western countries, its study has not been done in our context where patient does not want to go for surgical intervention. The aim of this study is to observe the evidence based outcome of local steroid injection in carpal tunnel syndrome in our perspective.

Materials and Methods

This is a prospective, interventional and observational study conducted in 40 patients of CTS who visited to OPD in Orthopaedics department at Janaki Medical College, between 2018 to 2021.

The patients of primary, idiopathic CTS, age between 18 to 70 years, with classic symptoms of CTS for at least 3 months duration were included in the study.

The patients with thenar muscles atrophy, previous steroid injection in the same wrist, those who were pregnant or had diabetes mellitus, hypothyroidism, inflammatory arthropathy, polyneuropathy and those with trauma to affected wrist in preceding year were excluded from the study group.

The diagnosis of CTS was made mostly on the basis of history and physical examination. The nerve conduction study was done in 8 cases in whom physical examination tests were doubtful.

Injection Technique

The patient were positioned comfortably in a supine position. The affected hand was supinated with the dorsal aspect of the wrist resting over a small rolled towel. Then the flexor Carpi radialis (FCR) and Plamaris longus (PL) tendons were located. The PL tendon is medial to FCR and is best located by opposing the thumb to 5th digit while the wrist is flexed. Skin was disinfected with betadine & spirit. 2ml of 2% Xylocaine was drawn in a syringe and with the wrist in slight dorsiflexion, the needle was advanced at approximately 30° angle to the skin and aimed in a slightly radial direction, entering the carpal tunnel just beneath the transverse carpal ligament (Figure 1).

Figure 1: *Needle placement for injection into carpal tunnel*

If patient feels paresthesia in hand, the needle should be withdrawn and redirected more superficially to avoid direct injection of steroid solution into the median nerve. Then 2ml of 2% Xylocaine was injected into the carpel tunnel with little or no resistance. The syringe was removed and another syringe filled with 40mg methyl prednisolone was reattached to needle and injected into the carpal tunnel, taking care not to alter the placement of needle within the canal. Lastly the needle was removed and the patient was advised to actively move the fingers for several minutes to distribute the solution evenly. The patient was given NSAIDs for 1 week and wrist splint to wear at night [7].

Patients were asked to come for follow-up at 6 weeks, 3 months & 6 months. The outcome following local steroid injection was assessed by Boston Carpal tunnel Questionnaire (BCTQ) [8,9] (Table 1). The patients were assessed at the time of presentation (i.e prior to injection) and during follow-up at 6 weeks, 3 months & 6 months following steroid injection.

Table 1: *Boston Carpal Tunnel Questionnaire (BCTQ)*

Boston Carpal Tunnel Questionnaire

Name:.....
Hand: ( ) Right ( ) Left
Injection Date: ...../...../.....
Evaluation Date: ...../...../.....

THE FOLLOWING QUESTIONS REFER TO YOUR SYMPTOMS WITHIN A TYPICAL PERIOD OF 24 HOURS, DURING THE LAST TWO WEEKS.
(Choose one answer in each question)

1) How strong is the pain on your hand or wrist at night?
1- I feel no pain on hand or wrist at night.
2- little pain
3- moderate pain
4- intense pain
5- severe pain

2) How many times did your hand or wrist pain wake you up in a typical night for the last two weeks?
1- never
2- once
3- twice or three times
4- four to five times
5- more than five times

3) Do you usually feel hand or wrist pain during the day?
1- I never feel pain during the day
2- I feel little pain during the day
3- I feel moderate pain during the day
4- I feel intense pain during the day
5- I feel severe pain during the day

4) How often do you feel hand or wrist pain during the day?
1- never
2- once or twice a day
3- three to five times a day
4- more than five times a day
5- constant pain

5) In average, how long do daytime pain episodes last?
1- I never feel pain during the day
2- less than 10 minutes
3- from 10 to 60 minutes
4- more than 60 minutes
5- I feel constant pain during the day

6) Do you feel your hand dormant (lost sensitiveness)?
1- no
2- I feel little dormancy
3- I feel moderate dormancy
4- I feel intense dormancy
5- I feel severe dormancy

7) Do you feel weakness on your hand or wrist?
1- no weakness
2- little weakness
3- moderate weakness
4- intense weakness
5- severe weakness

8) Do you feel a tingling sensation on your hand?
1- no tingling sensation
2- little tingling sensation
3- moderate tingling sensation
4- intense tingling sensation
5- severe tingling sensation

9) How strong is dormancy (lost sensitivity) or tingling sensation at night?
1- I never feel dormancy or tingling sensation at night
2- little
3- moderate
4- intense
5- severe

10) How often did dormancy or tingling sensation wake you up during a typical night for the last two weeks?
1- never
2- once
3- twice to three times
4- four to five times
5- more than five times

11) How difficult do you feel in taking and using small objects, such as keys or pens?
1- not difficult
2- a little difficult
3- moderately difficult
4- very difficult
5- severely difficult

IN A TYPICAL DAY FOR THE LAST TWO WEEKS, HAVE YOUR HAND OR WRIST SYMPTOMS BROUGHT ANY DIFFICULTY IN PERFORMING THE ACTIVITIES LISTED BELOW?

Please, circle the number that best describes your ability to perform the activity.

ACTIVITY	DEGREE OF DIFFICULTY				
Writing	1	2	3	4	5
Buttoning clothes	1	2	3	4	5
Holding a book while reading	1	2	3	4	5
Holding the telephone hang	1	2	3	4	5
Housekeeping	1	2	3	4	5
Opening a glass vial cap	1	2	3	4	5
Carrying market bags	1	2	3	4	5
Bathing and dressing	1	2	3	4	5

No difficulty 1
Little difficulty 2
Moderate difficulty 3
Intense difficulty 4
Cannot perform the activity at all due to hands and wrists symptoms 5

Investigator's opinion: .....

Results

A total of 40 patients (56 hands) meeting the inclusion criteria were assessed in this study. Among 40 patients, 28 patients (70%) were female, with mean age 35yrs (range 18 to 70yrs) and mean duration of symptoms 7.5 months (range 3 to 18mths). Most patients had tingling sensation and numbness in the distribution of median nerve with worsening of symptoms during night. 32 patients were diagnosed clinically and in 8 patients diagnosis was confirmed with nerve conduction study.

Following local steroid injection, 28 patients (70%) had significant improvement in the symptoms upto last follow-up (i.e 6 months) while 4 patients had recurrence of symptoms at 3 months and 8 patients had recurrence at 6 months. Local steroid injection was repeated in these 12 patients. Six of these patients had improvement in symptoms following re-injection while the other 6 patients didn't improve with re-injection and surgery was advised. The Boston symptoms severity and functional scores showed significant improvement following steroid injection at each follow-up in comparison to scores at the time of presentation (P-Value 0.0001). There is no significant difference in SSS at 6wks & 3mths F/U (P-Value 0.274) and at 3mths & 6mths F/U (P-Value 0.1663) but there is significant difference in SSS at 6wks & 6mths F/U (P-Value 0.0145). Similarly there is no significant difference in FS at 3mths & 6mths F/U (P-Value 0.2142) while there is significant difference in FS at 6wks & 3mths F/U (P-Value 0.0345) and at 6wks & 6mths F/U (P-Value 0.0018) (Table2 & 3; Figure 2).

No any major adverse effects was seen following local steroid injection in patients with CTS. Mild discolouration of the skin colour over the site of injection was seen in 6 patients.

Table 2: *Mean, Std. deviation (SD) and P-value of Symptom severity scores (SSS)*

Characteristics	n	Mean	SD	P-Value
SSS at the time of Presentation	40	3.09	0.48	Ref.
SSS at 6Wks F/U	40	1.38	0.34	0.0001*
SSS at 3Mths F/U	40	1.52	0.73	0.0001*
SSS at 6Mths F/U	40	1.79	0.98	0.0001*

*Significant difference

Comparison of P-value of Symptoms Severity Scores (SSS):
P-Value (6wks F/U Vs 3mths F/U) = 0.274
P-Value (6wks F/U Vs 6mths F/U) = 0.0145*
P-Value (3mths F/U Vs 6mths F/U) = 0.1663

Table 3: *Mean, Std. deviation (SD) and P-value of Functional scores (FS)*

Characteristics	n	Mean	SD	P-Value
FS at the time of Presentation	40	3.11	0.44	Ref.
FS at 6Wks F/U	40	1.23	0.19	0.0001*
FS at 3Mths F/U	40	1.49	0.74	0.0001*
FS at 6Mths F/U	40	1.73	0.96	0.0001*

*Significant difference

Comparison of P-value of Functional Scores (FS):
P-Value (6wks F/U Vs 3mths F/U) = 0.0345*
P-Value (6wks F/U Vs 6mths F/U) = 0.0018*
P-Value (3mths F/U Vs 6mths F/U) = 0.2142

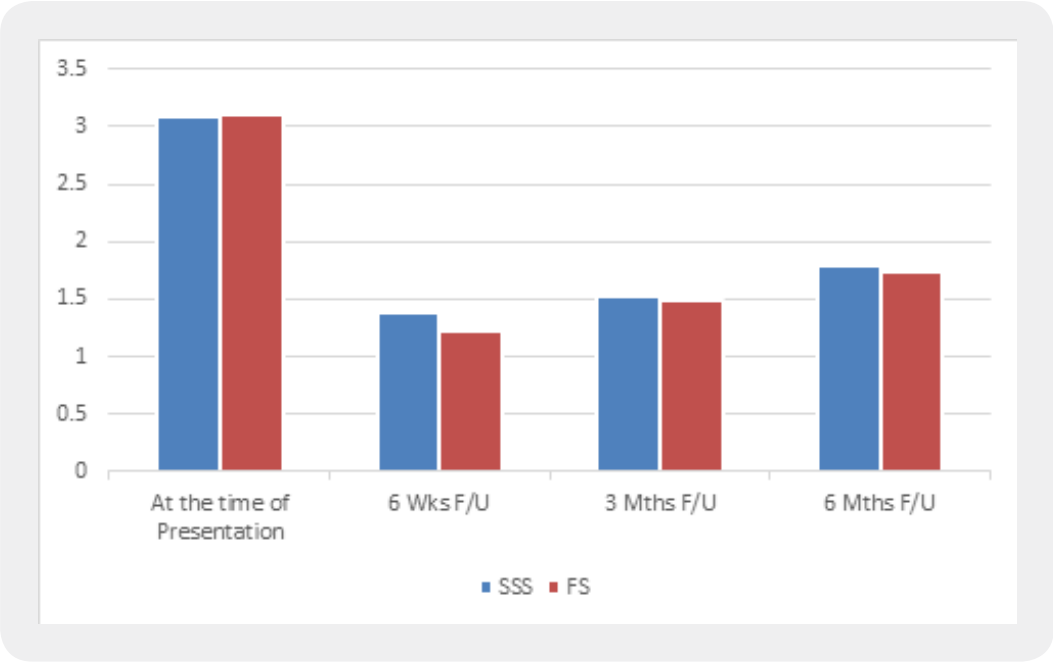

Figure 2: *Mean Symptoms severity scores (SSS) & Functional scores (FS)*

Discussion

CTS is the most common compression neuropathies with female predominance. Local steroid injection is considered safe and effective treatment for the relief of symptoms associated with CTS. Steroid injection relieves local ischemia, inflammation or synovial swelling around the median nerve and reduces vascular congestion in the carpal tunnel [10]. Surgical decompression of median nerve in carpal tunnel should be reserved for patients with weakness or atrophy of thenar muscles, inflammatory arthropathy, polyneuropathy and failure of repeated steroid injections.

Agarwal V *et al.*, in their study of 48 patients with idiopathic mild CTS treated with single dose of local injection of 40mg methyl prednisolone acetate, found 93.7% of patients had marked improvement in their symptoms at 3mths follow-up and 79% of patients continued to have improvement in their symptoms at median follow-up of 16mths. Eight patients (16.6%) relapsed following the initial response. They concluded that local glucocorticoid injection results in long-term improvement in nerve conduction parameters, symptoms severity & functional scores in patients with mild CTS [11]. Ly-pen D *et al.*, in their study of surgical decompression versus local steroid injection in CTS, evaluated 163 wrists in which 80 wrists were randomly assigned to surgery group and 83 wrists to local steroid injection group. They concluded that over the short term, local steroid injection is better than surgical decompression for the symptomatic relief of CTS. At 1year, local steroid injection is as effective as surgical decompression for the symptomatic relief of CTS [12]. Gilberman *et al.*, in their prospective study of steroid injection and splinting in 41 patients with nine Pts. having bilateral involvement, treated with single injection of triamcinolone & 3 weeks of wrist splinting, found that 22% Pts. were completely symptoms free at average follow-up of 18 months. They

concluded that Pts. with mild symptoms of less than 12mths duration, normal thenar strength & mass had the most satisfactory responses to injection & splinting. Pts. with severe symptoms of more than 12mths duration & findings of atrophy, weakness and marked prolongations on nerve-conduction study had poorest response to injections with high relapse rate [13]. Zaidi S *et al.*, in their study of intra-carpal tunnel steroid injection Vs NSAIDs in CTS, evaluated 46 patients (23 Pts. were treated with intra-carpal tunnel steroid injection & 23 Pts. with NSAIDs), found steroid group showed better direct treatment response & perceived improvement than NSAIDs group. They concluded intra-carpal tunnel steroids injection was more effective as compared to NSAIDs in the management of CTS [14]. Hofer *et al.*, in their extended follow-up of local steroid injection for carpal tunnel syndrome concluded that local methylprednisolone injection in idiopathic CTS resulted in statistically significant reduction in surgery rates & delay in need for surgery [15]. The results in our study are comparable with above studies.

Some study also advocates that the Ultrasound-guided injection yielded more favorable results than landmark-guided injection. Therefore nowadays Ultrasound-guided corticosteroid injection is recommended for patients with CTS [16].

Conclusion

Local steroid injection is safe and effective treatment for the relief of symptoms in patients of CTS and should be considered as the first-line therapy. Surgical decompression of median nerve should be reserved for patients with severe CTS with atrophy of thenar muscles and failure of repeated steroid injections.

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