

EFFICACY OF ULTRASOUND GUIDED CORTICOSTEROID INJECTION IN CARPAL TUNNEL SYNDROME

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ABSTRACT

Background: Carpal tunnel syndrome is the most common peripheral nerve entrapment syndrome. Females are affected more than males. Corticosteroid injections are very effective in mild to moderate carpal tunnel syndrome on short and in some cases on long term basis. The objective of the study was to evaluate the efficacy and clinical outcomes of ultrasound guided corticosteroid injection for treatment of carpal tunnel syndrome.

Methods: This prospective cross-sectional study was carried out on OPD basis at Department of Orthopedic surgery Services Hospital Lahore. A total number of 80 patients were included in this study. Each patient was injected triamcinolone 40 mg with 2 % xylocaine. After the injection every patient was followed at 6 weeks, 3 months and at 6 months. At each follow up these patients were assessed by Phalen test, Tinel sign, Boston carpal tunnel syndrome severity score, functional assessment scale, electrophysiological studies and nerve conduction study.

Results: 40 female patients were housewives; 25 male patients were manual workers and remaining 15 patients were computer operator. 30 patients had mild symptoms of carpal tunnel syndrome, 35 had moderate while the remaining 15 patients had severe symptoms of carpal tunnel syndrome. All these patients were having symptoms for the last 6-12 weeks which did not improve with the conservative management. These patients were having symptoms of numbness and tingling at the initial presentation. Phalen test was positive in 95 % (76 patients) patients while Tinel test was positive in 80 % patients (64 patients) at the initial presentation. Boston's severity symptom score was 35.34 +/- 3.59 and functional status scale was 25.43 + 5.82 (At the initial presentation) in all patients. Following corticosteroid injection at 06 weeks the symptoms severity score was 21+/-3.32 (mean) and at 03 months 18.80 + 3.41(mean) in 72 patients while 8 patients did not respond to corticosteroid injection while the functional status scale 17.62 +- 5.01 and 13.45 +- 4.2 at 03 months. Electrophysiological study was also improved after 06 weeks and after 03 months.

Conclusion: Corticosteroid injections are very effective regarding the outcomes on short term basis. However, they are effective in small number of patients on long term basis

Key words: Corticosteroid, carpal tunnels syndrome, triamcinolone acetamide, Boston carpal tunnel syndrome.

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INTRODUCTION

The etiology can be hereditary, repetitive movements of the wrist in mechanical workers, injury to the wrist, pregnancy, obesity, metabolic disorders, auto immune conditions such as diabetes mellitus, rheumatoid arthritis and in elderly population. Carpal tunnel syndrome is the compressive neuropathy of the median

nerve under the carpal tunnel. It occurs in 6-8 % of elderly population and accounts for 90 % of all compressive neuropathies. Females are affected ten times more than males³.

Carpal tunnel is a narrow passage at the wrist. It protects the median nerve and flexor tendons. Its floor is formed by the carpal bones while roof is formed by the transverse carpal ligament. The boundaries of carpal tunnel are rigid and have got little space to stretch. Either the space becomes narrow or the tissue surrounding the flexor tendon become overcrowded putting pressure on the median nerve. Median nerve has got sensory supply to the index, middle, the ring finger. Because of overcrowding, an abnormal pressure is exerted on the nerve which causes pain, numbness, tingling and weakness of the hand. In addition, high pressure on the median nerve produces gradual ischemia and inflammation of intracarpal tendons which further produces swelling resulting in increased compression of the median nerve.

No single factor is responsible for carpal tunnel syndrome. In addition to female sex and old age, hereditary & obesity are responsible for carpal tunnel syndrome¹³. People who have profession that involve repetitive movements of hand and wrist & trauma to the wrist bones also put increased pressure on the median nerve⁷. Moreover, the hormonal changes during pregnancy can cause the carpal tunnel syndrome. Autoimmune diseases like diabetes mellitus, hypothyroidism and rheumatoid arthritis also can cause carpal tunnel syndrome¹².

The carpal tunnel syndrome can be diagnosed from history, clinical examination including Phalen test, Tinel sign, USG, MRI, electrophysiological study and nerve conduction study. The severity of the disease can be assessed by symptoms severity score and functional status scale^{1,8}.

A variety of non-surgical and surgical methods are available to treat the carpal tunnel syndrome. Patients usually seek the conservative management before adapting the surgical intervention^{11,14,21}.

However, the conservative options such as NSAIDs, diuretics, physiotherapy, extracorporeal shockwave therapy, night splintage & PRP injections have beneficial effects in the initial stage^{2,17,20,22}.

The use of corticosteroid injection has shown significant improvement in carpal tunnel syndrome. Corticosteroid has got anti-inflammatory and anti-thrombotic effects that relieves the symptoms of carpal tunnel syndrome. Current evidences suggest that the benefits achieved from corticosteroid injection last for more than 01 - 03 months^{18,23}. Benefits may last for more than 12 months in patients with mild to moderate disease, but the number of patients receiving the long-term benefits are less²⁴. But still, it limits the need of surgical release for

these patients who receive the corticosteroid injection treatment¹⁶. Ultrasound guided corticosteroid injection reduces the injection related complications, less invasive and improve the patient confidence and satisfaction⁴⁻⁶.

The American Academy of Orthopaedic Surgeons also recommend corticosteroid injection for mild to moderate carpal tunnel syndrome before going for surgical intervention. Similar recommendations have been given by the American College of Occupational and Environmental medicine for subacute and chronic carpal tunnel syndrome²⁶. The specific recommendations for second injection are not clear, but if the disease is severe (> 12 weeks) then the corticosteroid injections can be repeated^{10,25}.

The exact dose for corticosteroid injection also varies from 40 – 80 mg of triamcinolone acetonide¹⁵. Before it is given it should be mixed with 2% xylocaine.

If the symptoms are not relieved with conservative measures, one can get relief from surgical release of carpal tunnel¹⁹. This can be achieved by open surgical release or with endoscopic technique.

METHODS

After permission from the hospital ethical review board, this observational study was carried out at Department of Orthopaedic Surgery, Services Hospital, Lahore from Dec 2018 - Dec 2019 on OPD basis. A total number of 80 patients were included in the study, there were 40 male and 40 females. A written permission was taken from each patient regarding the procedure. Patients with age between 18 – 70 years with mild to moderate carpal tunnel syndrome were included in the study. Patients with age less than 18 years, with muscle weakness, hand infection, patients with severe carpal tunnel syndrome and patients with cervical radiculopathy were excluded from the study. The duration of symptoms of carpal tunnel syndrome was 6 – 12 weeks. After complete ASM, these patients were injected 40 mg of triamcinolone acetonide mixed with 2 % of xylocaine in the carpal tunnel with ultra-sound guided technique. Electro-physiological parameters before and after injections at 3 months were compared with paired t test with $p < .05$ as statistical significance.

FOLLOW UP: All patients were followed at an interval of 06 weeks, 03 months and at 06 months period. At each follow up each patient was assessed by Phalen test, Tinel sign, nerve conduction study and electrophysiological study. All participants in the study were given a written questionnaire (Boston carpal tunnel syndrome questionnaire). It includes the symptom severity scale (11 points) and functional status scale (8 items) before the start of treatment and at each follow up. A higher Boston risk scale indicates a poor function.

Sensory nerve action potential of < 50 m/sec while DML > 4.2 m/sec indicate carpal tunnel syndrome.

RESULTS

Our study included 80 patients with 40 males and 40 females. 40 female patients were housewives, 25 male patients were manual workers and remaining 15 patients were computer operator. 30 patients had mild symptoms of carpal tunnel syndrome, 35 had moderate while the remaining 15 patients had severe symptoms of carpal tunnel syndrome. All these patients were having symptoms for the last 6 – 12 weeks which did not improve with the conservative management. These patients were having symptoms of numbness and tingling at the initial presentation. Phalen test was positive in 95 % (76 patients) patients while Tinel test was positive in 80 % patients (64 patients) at the initial presentation.

The symptoms severity was assessed by using Boston carpal tunnel syndrome questionnaire. These are the patients reported outcomes measures which were performed by sending these questionnaires to the patients at the initial presentation, at 06 weeks, 03 months and 06 months. The symptom severity scale has 11 items and each question has 05 points scale. Each scale creates the final score i.e., sum of individual items score divided by number of items. The higher the symptom severity scale more severe is the disease. The functional status scale has 08 points (FSS). Boston’s severity symptom score was 35.34 +/- 3.59 and functional status scale was 25.43 + 5.82 (At the initial presentation) in all patients. Following corticosteroid injection at 06 weeks the symptoms severity score was 21+/-3.32 (mean) and at 03 months 18.80 + 3.41(mean) in 72 patients while 8 patients did not respond to corticosteroid injection while the functional status scale 17.62 +- 5.01 and 13.45 +- 4.2 at 03 months. After 06 months, 30 patients out of 80 patients developed recurrence of the symptoms. 30 patients developed recurrence of symptoms and all these patients required the second injection of CSI and their symptoms resolved after the second CSI.

08 patients did not respond to the injection and ultimately, they require the surgery. Both the SSS and FSS were not improved in these 08 patients. Electro physiological study including distal motor latency (DML), distal sensory latency at mid palm (DSL-MP) & distal sensory latency at wrist (DSL-W) showed continues improvement at 03rd month in 72 patients. These also show the improvement at 05 weeks & at 03 months. But at 06 months in 40 patients out of 80 patients it again regressed. DML (ms) and SNAP MP (uv) showed a statistically significant improvement at 3 months. (p<.05).

Sensory nerve action potential at mid palm = SNAP-MP, Sensory nerve conduction velocity at wrist =

SNVC-W, Distal motor latency = DML, Distal sensory latency at wrist = DSL-W, Distal sensory latency at mid palm = DSL-MP.

No adverse unexpected effects for serious events were noted except in 07 patients who had discoloration of skin & hot flushes which resolved after 06 weeks in these patients without any medication.

Table 1: Electro physiological parameters before & after injection at 06 weeks & 03 months

	Before Inj.	At 06 weeks	03 Months	Paired t test before and at 3 months p value
DML (ms)	5.30 (2.3)	4.32 (1.5)	4.09 (1.08)	P = 0.000
DSL-MP (ms)	1.66 (1.32)	1.2 (0.92)	1.33 (1.3)	P = 0.113
SNAP MP (uv)	25.2 (17.20)	33.10 (32.10)	32.01 (25.03)	P = 0.047
DSL W (ms)	3.4 (1.40)	2.41 (1.11)	3.66 (1.28)	P = 0.222
SNAP W (uv)	19.3 (17.0)	18.85 (16.0)	22.30 (11.80)	P = 0.197
SNCV W (m/s)	38 (19.0)	39.9 (18.8)	42 (18.0)	P = 0.174

DISCUSSION

Carpal tunnel is a compressive neuropathy of median nerve at the wrist. It is classified as mild, moderate and severe. Although no criteria to categorize exist unless loss of motor function and sensory loss is present, the initial treatment for the disease usually consists of steroid injection in carpal tunnel¹.

In our study 80 patients received the corticosteroid injections. Out of 80 patients, 72 patients having physical findings with binary outcomes including tingling, pain, numbness, day time numbness, Phalen test, Tinel sign and nerve conduction studies improved significantly at 06 weeks & at 03 months. Symptoms severity score & functional assessment scale also improved at 06 weeks & at 03 months⁸. Moreover, the electro physiological findings also improved from 06 weeks to 03 months.

The clinical benefits local corticosteroid injections have well been established in lot of studies.^{2,5,6,16}. Study conducted by B. Hoffecker reveals that corticosteroid injections for carpal tunnel syndrome are effective for period longer than 12 months. Moreover the 2nd injection also decreased the need for surgery.²³ Another study done by Ertem et al also shows that local

corticosteroid injection for CTS provide short term improvement in neuro physiological & clinical outcomes. The functional ability & symptoms severity improved with CSI.¹⁸ In his study on randomized controlled trial of local CSI in Carpal Tunnel Syndrome Veluthamangal et al. came to the conclusion that CSI are effective on short term basis.²⁴ The study conducted by Mustafa et al. on 21 patients with carpal tunnel syndrome also shows a significant improvement after CSI injection regarding the electrophysiological & nerve conduction studies.²⁵ In a prospective randomized control trial on patients with carpal tunnel syndrome, Ozgur et al came to the conclusion that USG guided and blind CSI, both had good results in CTS. However, USG injections yield more effective clinical and electrophysiological improvement.⁴

All these studies suggest that symptoms improvement in patients who underwent intra sheath injection of corticosteroid under ultrasound guide is excellent & provides the short-term relief in CTS.

CONCLUSION

We concluded ultrasound guided CSI are safe, less invasive and is without permanent side effects. Although it provides relief in short term basis still it is a useful procedure in patients with failed conservative treatment & in patients with severe carpal tunnel syndrome who are not willing for surgery.

LIMITATIONS OF THE STUDY

The follow-up duration of our study was small. The effectiveness of local steroid injection was not compared to other treatment options. Moreover, USG injection is user dependent. Ultrasound examination and ultrasound guided injection require a lot of experiences in musculoskeletal USG. Can be performed only by person experienced in musculoskeletal USG.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ETHICAL REVIEW BOARD APPROVAL

The approval for the study was approved from Institutional Review Board of Services Institute of Medical Sciences / Services Hospital, Lahore via reference No. 140/18 dated December 9,2018.

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AUTHOR'S CONTRIBUTIONS

MZIS: Manuscript writing, Data collection

MK: Manuscript writing

TH: Statistical analysis, data collection.

AI: Statistical analysis