Journal of Advances in Medicine and Medical Research

33(3): 21-27, 2021; Article no.JAMMR.65439
ISSN: 2456-8899
(Past name: British Journal of Medicine and Medical Research, Past ISSN: 2231-0614, NLM ID: 101570965)

Evaluation of Local Corticosteroids Injection in Treatment of Carpal Tunnel Syndrome

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JAMMR/2021/v33i330817
Editor(s):
(1) Dr. Ashish Anand, University of Mississippi Medical Center, USA and William Carey School of Osteopathic Medicine, USA.
Reviewers:
(1) Liranso G. Selamu, Seoul National University, South Korea.
(2) Ana Cristina Leandro, The University of Texas Rio Grande Valley (UTRGV), USA.
Complete Peer review History: http://www.sdiarticle4.com/review-history/65439

Original Research Article

Received 10 December 2020
Accepted 15 February 2021
Published 23 February 2021

ABSTRACT

Background: Carpal tunnel syndrome is the most common type of peripheral nerve entrapment; it affects females more than males; it may be idiopathic or secondary to other disorders especially diabetes mellitus. Carpal tunnel syndrome mostly affects manual workers and may be bilateral or unilateral and mainly affects the dominant hand. Carpal tunnel syndrome has characteristic symptoms and signs including paresthesia and pain along median nerve distribution, these symptoms are usually accompanied by positive provocative tests. Electrodiagnostic studies remain the cornerstone in the diagnosis of CTS. Carpal tunnel syndrome can be treated conservatively by activities of daily living instructions, splints, medical treatments as neurotropic drugs and NSAIDs and local steroid injection. Also, it can be treated by surgical decompression in severe cases.
Aims: The aim of this study was to evaluate local steroid injection in the treatment of CTS. Twenty-one patients with mild and moderate CTS were included in this study.
Patients and Methods: This was a prospective study included 21 patients with symptoms and signs of mild to moderate CTS attending the outpatient clinic of orthopedic Department, Tanta University Hospitals in the period between February 2019- January 2020. 1 ml Triamcinolone was used with 2 ml lidocaine. Patient' hand was rested on towel roll flexed about 30 to 45 degrees and injection was done according to landmarks. Night splint was described for 3 days after injection.

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Results: In regards to clinical assessment; there was a significant clinical improvement after injection and follow-up period as compared to before injection. In regards to electrophysiological assessment; there was a significant improvement in NCS after injection.
Conclusion: Local steroid injection is an effective treatment and recommended as a therapeutic tool in the management of idiopathic mild to moderate CTS.

Keywords: Corticosteroids; carpal tunnel syndrome.

1. INTRODUCTION

Carpal tunnel syndrome (CTS) is the most common peripheral entrapment neuropathy in the upper extremity with a prevalence of 3.7% in the adult general population [1].

The prevalence of persons who have moderate or severe CTS but have not sought care or been diagnosed correctly is almost 1% in the general population [2].

CTS of mild severity is commonly treated with wrist splint but for moderate and severe symptoms surgical treatment is often required. Carpal tunnel release is one of the most common surgical procedures; the annual incidence in a US population was 134 per 100,000 [3].

Although carpal tunnel release has been shown to produce good outcomes regarding the relief of symptoms caused by CTS, it has several disadvantages including surgery-related pain and hand weakness. These are common problems and may last several months after surgery. Other less common complications include wound infection, chronic regional pain syndrome, and nerve injuries [4].

In addition, surgery is associated with direct costs as well as indirect costs related to work absence after surgery because the majority of patients require sick leave for a varying length of time depending on the degree of postoperative morbidity and the type of work. The median time of work absence has been 4 weeks in several studies, with a proportion of patients having long-term work disability [5].

The economic impact of work absence following surgery for CTS can affect both the patients and the society [6].

Consequently, avoiding sick leave would be an important advantage for nonsurgical treatment [7].

Although many alternatives to surgery have been proposed there is little evidence to support the efficacy of most of these treatments. Steroid injection into or proximal to the carpal tunnel is widely practiced in the treatment of patients with idiopathic CTS, particularly in the United States [8].

2. PATIENTS AND METHODS

This was a prospective study that included 21 patients with symptoms and signs of mild to moderate CTS attending the outpatient clinic of orthopedic Department, Tanta University Hospitals in the period between February 2019-January 2020.

2.1 Inclusion Criteria

a. Primary, idiopathic CTS
b. Symptom duration of at least 1 month
c. Inadequate response to wrist splint and medical treatment.
d. Mild to moderate CTS
e. Patient unwilling to undergo surgery

2.2 Exclusion Criteria

a. Previous steroid injection in same the wrist
b. Inflammatory joint disease
c. polyneuropathy
d. Trauma to the affected wrist
e. Previous CTS surgery on the affected side
f. Severe CTS.
g. Drug or alcohol abuse

Patients were subjected to the following:

Full history taking:

- Personal history: name, age, sex and residency.
- Medical history: diabetes, autoimmune disease, inflammatory joint disease, drug abuse, smoking and pregnancy history.
- Surgical history: previous operation on the upper extremity.

- History of trauma to the limb especially to the affected wrist.

Clinical examination:

- General examination e.g signs of thyroid disease.
- Local examination: a full local examination of the affected side.
- Special tests: Phalen test, Tinnel test and direct compression test.

Investigations:

1. Laboratory investigations: blood count, blood glucose level, ESR and RF.
2. Radiological: plain x-ray (AP, lateral and tunnel views) on the wrist joints on both sides and cervical spine.
3. Nerve conduction study.

2.3 Methods

2.3.1 Preparations

Corticosteroid: Triamcinolone 1 ml.
Anesthetic: Lidocaine 1% 2 ml.

2.3.2 Technique

Wrist position:

The wrist was dorsiflexed at 30 degrees resting on towel roll.

Injection site:

a. Proximal wrist crease (or 1cm proximal to most distal wrist crease)
b. Ulnar side of following landmark:

1. Palmaris longus tendon: can be recognized by opposing thumb to little finger or flex middle finger against resistance.
2. Wrist midline if palmaris longus absent

c. Needle insertion:

1. Antiseptic was applied to skin (betadine).
2. The needle was aimed 30-40 degrees distally toward middle-ring finger.
3. The Needle was inserted 1-2 cm until no resistance.
4. If there was paresthesia this is indicator that the needle was at median nerve so, the needle was removed and replaced further to ulnar side

2.4 Statistical Analysis

Statistical presentation and analysis of the present study was conducted, using the mean, standard deviation and chi-square test by SPSS V.16

3. RESULTS

Asymptomatic was considered as an excellent result, mild was considered as good results and moderate was considered as a poor result.

3.1 The Results Outcome According to Boston Carpal Tunnel Syndrome Questionnaire (BCTQ)

Pre-injection: There were two patients with mild severity (9.5%) and 19 patients with moderate severity (90.5%).

Post-injection: There was significant symptomatic and functional improvement detected in the first follow-up after two weeks. The two patients of mild severity and 10 patients out of 19 with moderate severity became asymptomatic after injection while 5 patients became mild and 4 patients still moderate with no improvement.

According to (Table 3) there was significant correlation between the patients change of jobs and the results outcome P. Value < 0.001.

3.2 There was Significant Correlation between Nerve Conduction Study Post Injection and the Result Outcome

Pre-injection: There were two patients with mild CTS (9.5%), 16 with moderate CTS (76.2%) and three patients with moderate to severe CTS (14.3%).

Post-injection: There was a significant improvement in the severity of CTS according to NCS after injection by three months.

The two patients with mild CTS according to NCS one of them became with normal NCS (4.8%) and the other still with mild CTS.

13 patients became with mild CTS (61.9%), 4 patients still with moderate CTS (19%) and three patients still with moderate to severe CTS (14.3%).

Table 1. Distribution of cases according to the results outcome

Case severity	Pre-injection	Post-injection	End results	
Asymptomatic	0	0	12	Excellent
Mild	2	2 asymptomatic	5	Good
Moderate	19	10 asymptomatic 5 mild 4 moderate	4	Poor
Total	21 (100%)	21 (100%)	21 (100%)	

Table 2. The results outcome according to Boston Carpal Tunnel Syndrome Questionnaire (BCTQ)

BCTQ	Pre-injection		Post-injection		p
	No.	%	No.	%	
Asymptomatic	0	0.0	12	57.1	<0.001
Mild	2	9.5	5	23.8	
Moderate	19	90.5	4	19.0	
Total	21 (100%)		21 (100%)		

Table 3. The results outcome according to changes of patients' job nature

	Regular full-time work	Part time work	Change work	Unemployed	Total	p
Pre-injection	0 (0.0%)	7 (33.3%)	10 (47.7%)	4 (19%)	21 (100%)	<0.001
Post-injection	12 (57.2%)	5 (23.8%)	0	4 (19%)	21 (100%)	

Table 4. The results outcome according to nerve conduction study (NCS)

Electrodiagnosis by NCS					Clinical diagnosis by BCTQ			
Severity of NCS	Pre-injection		Post-injection		Asymptomatic	Mild	Moderate	p
	No.	%	No.	%				
Normal	0	0.0	1	4.8	1	0	0	<0.001
Mild	2	9.5	13	61.9	11	2	0	
Moderate	16	76.2	4	19.0	0	3	1	
Moderate to sever	3	14.3	3	14.3	0	0	3	

4. DISCUSSION

Carpal tunnel syndrome is the most common peripheral nerve neuropathy. It arises from the entrapment of the median nerve as it passes through the carpal tunnel from the wrist to the hand [9].

Increased pressure on the median nerve in the carpal tunnel can result in progressive sensory and motor disturbances on parts of the hand innervated by this nerve, leading to pain and loss of function [9].

CTS may be primary or secondary to many causes and precipitating factors, diabetes mellitus is one of the most common causes of secondary CTS [9].

Diagnosis of CTS is mainly a clinical one based on the history and physical examination by Tinnel sign, Phanel's and Direct compression tests [10].

Diagnosis of CTS is confirmed by NCS which is considered to be the gold standard in the diagnosis as it is an objective test that gives details on the physiological fitness of the median nerve across the carpal tunnel. The usefulness of NCS includes objective confirmation of nerve involvement, grading of severity and excluding polyneuropathy [11].

Ultrasonography has emerged as a simple, relatively low cost, rapid, accurate and non-invasive imaging method for evaluating the median nerve in the carpal tunnel to detect changes in the nerve shape, exclude anatomical

variants and space occupying lesions as ganglion cysts and tenosynovitis [12].

Treatment of idiopathic CTS ranges from conservative management (physical modalities, medical treatment and wrist splint), corticosteroid injection to surgical decompression depending on the degree and duration of symptoms and etiology of the disease and degree of severity by NCS [13].

The patients' occupations in our study were of manual type, 19 patients (90.5%) were housewives, 14 out of 19 were farmers (66.7%) and the other two patients (9.5%) were accountant and carpenter with an insignificant correlation between patients' occupations and the end results.

These results are similar to the study done by Saphin et al. [14] who reported that it is possible to identify manual loadings (including wrist flexion, powerful handgrip) as a higher risk for CTS, which causes frictional inflammation that may lead to tendon sheath swelling and increased pressure around the median nerve inside the carpal tunnel. These loadings are usually combined during occupational work.

Most of the patients couldn't continue their works, some patients change their occupation nature and some patients became unemployed due to symptoms of CTS. This was significantly changed after treatment; 12 patients became able to continue their works full-time and 5 patients became able to continue their works but as part-time due to incomplete resolution of pain and the remaining 4 patients who showed no improvement to treatment still unemployed.

Regarding the severity of CTS by NCS, 2 patients were mild (9.5%) one of them became with normal NCS after treatment and the other still with mild CTS. 16 patients were moderate (76.2%), 6 patients out of 16 became with mild severity and the remaining 10 still with moderate severity. 3 patients (14.3%) were moderate to severe CTS who show no improvement after treatment. Most of cases had moderate CTS.

This was agreed with Iranmanesh et al. [15], Hasan and Ali [16] and Mohammad et al. [17] found that most ofthe cases had moderated CTS and fewer cases of mild and sever severity.

Other studies as Baiee et al. [18] found that most of their cases by NCS were mild CTS followed by moderate and severe CTS. While Mohamed et al. [19] and Rao et al. [20] found that most cases were having severe CTS followed by moderate and less mild cases.

NCS may not be an accurate diagnostic tool as false-negative and false-positive results have been reported. Patients with mild CTS may retain enough unaffected nerve fibers to maintain normal electro-diagnostic studies and hence may lead to NCS false negatives. Also, some studies showed that there may be an imperfect correlation between clinical data and the NCS [21].

This can explain the imperfect correlation between NCS and clinical assessment of CTS using BTCQ before and after treatment in our study.

Several studies have recommended the need for further studies besides clinical data for diagnosis of CTS such as US and MRI, considering that there are some drawbacks in the diagnostic accuracy of electrophysiological tests with sensitivity and specificity to be reported around 70% and 82% respectively failing to diagnose approximately 20–30% of CTS cases [21].

According to the scoring system, we used Boston carpal tunnel syndrome questionnaire (BCTQ). This is the most widely used questionnaire for scoring of CTS. It is a good indicator of the subjective severity of CTS symptoms and to be responsive to changes as a result of treatment [9].

5. CONCLUSION

According to BTCQ, there were 2 patients with mild severity (9.5%) who became asymptomatic after treatment. 19 patients with moderate severity (90.5%), 9 patients out of 19 became asymptomatic, 5 patients out of 19 became with mild severity and 4 patients show no improvement after treatment. We considered asymptomatic and mild as good results and moderate as poor results.

There was failure in treatment of 4 cases which with local steroid injection this may be due to:

1. Incorrect diagnosis
2. Incorrect injection technique
3. Associated disease e.g. cervical radiculopathy (double crush syndrome) or

median mononeuropathy e.g. Pronator teres syndrome.
4. Systemic disease that not diagnosed (secondary CTS)

In general, this study proved the efficiency of steroid injection as a treatment of mild to moderateidiopathic CTS and its advantages over surgery as avoidance of postoperative complications including wound infection, chronic regional pain syndrome, and nerve injuries. Also, surgery is associated with direct costs as well as indirect costs related to work absence after surgery.

6. RECOMMENDATION

Further studies are needed to compare its effectiveness with other therapeutic tools in CTS management.

CONSENT AND ETHICAL APPROVAL

As per international standard or university standard, patients' written consent has been collected and preserved by the authors. As per international standard or university standard written ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/65439