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Evaluating the Effectiveness of Surgical Treatment and Local Steroid Injection in Patients with Carpal Tunnel Syndrome

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Abstract

Background: Carpal tunnel syndrome (CTS) is considered as the most common entrapment neuropathy. Median nerve release by surgery is a manual therapy intervention used for treating CTS.

Objectives: The aim of the present study was to compare the effectiveness of surgical decompression with respect to local steroid injection in the treatment of idiopathic.

Methods: In this study, 100 patients with mild and moderate carpal tunnel syndrome were assigned to two equal groups. In one group, patients received a single local injection of triamcinolone acetonide and in the other one, open carpal tunnel release was used. A number of variables including pain (based on Visual Analogue Scale), symptom severity and functional status (based on Bostone/ Levine symptom severity and functional status scale) were assessed at the baseline and after a 6-month follow-up. Analysis was carried by intention to treat.

Results: the severity of symptoms in the surgery and injection groups was 2.51 and 2.61 respectively. However, in the follow-up, the severity of symptoms in the surgery group (1.77) was significantly lower than the injection group (2.62) ($p < 0.001$). Before the treatment, the mean limb function was 2.68 in the surgery group and 2.71 in the injection group. However, after the treatment, the mean performance score in the surgery group (1.74) was significantly lower than the injection group (2.58) ($p<0.0001$). Before the treatment, the amount of the mean pain was 5.82 in the surgery group and 5.86 in the group of injection. However, after the treatment, the mean pain score in the surgery group (0.63) was significantly lower than the injection group (1.72)($p = 0.0001$).

Conclusion: The findings suggested that both local steroid injection and surgical decompression were effective in alleviating symptoms of primary CTS after a 6-month follow-up but surgery offered additional benefits. In terms of security, conservative approach to surgery was preferred.

Keywords: Carpal tunnel syndrome, Corticosteroid, Surgery

1. Background

Carpal tunnel syndrome (CTS) was first identified by Paget in 1854 (1). The most common neuropathy compression of the upper extremity caused by compression of the median nerve in the carpal tunnel leads to the progressive impairment of sensation and movement in the territory of the median nerve (thumb, index, long and ring fingers on the arm) and is characterized with pain, paresthesia and weakness of the median nerve innervation (1). Also, there is muscle atrophy of hands under pressure in the later stages of median nerve neuropathy (1). This disease often affects the dominant hands, but in 87% of clinical patients and in 50% of neuropsychological tests, it may be bilateral (2). It may occur at any age (3), but it is often observed in people aged 30 to 60 years old with 80% of cases being reported in people over 40 (3). Women are five times more susceptible to this disorder (1). Currently, there is no accurate information about the prevalence of this disease in Iran. Carpal tunnel syndrome is multifactorial and systemic and its development could be intensified by local factors (3). Damage can be caused by frequent opening and strong wrist flexion and extension which are often associated with vibrating machines, driving, typing, holding objects such as phone and opening and closing buttons, among other things (1). Systemic conditions such as obesity, diabetes mellitus, rheumatoid arteritis, amyloidosis, thyroid disorders and Raynaud's phenomenon are sometimes associated with carpal tunnel syndrome (1). Some of its anatomical or variations elements can change the form or space to pass the elements and increase the pressure of carpal tunnel (4). Diagnosis is often based on a history of patient, physical examination and para-clinic findings (5).

The most sensitive diagnostic tests for the syndrome are Electromyography (EMG) and Nerve Conduction Velocity (NCV) (5). Several treatments for carpal tunnel syndrome have been suggested (1). Local corticosteroid injection and surgery are two standard treatment methods (1). Given the relatively high prevalence of this syndrome, especially in the elderly, the relatively high prevalence of risk factors, disruption of normal activities, diminished functionality of individuals costs of treatment especially surgery, costs of hospitalization, doctor

visits, physical therapy and early disability caused by this disease, which may lead to job change and impose possible financial loss on the patient in particular and economy at large, and the incidence of psychological problems in patients especially among working women from low-income people who cannot afford medical costs, it is necessary to select effective treatment (5). Surgery is an effective method for the treatment of this syndrome. However, due to the fear of open surgery and general anesthesia, which may leave a scar at the site of operation, length of hospitalization and delayed return to job, many people refuse this treatment. On the other hand, although local corticosteroid injection dose not completely eliminate the patient's symptoms and it only diminishes the symptoms, it is the preferred choice of patients. Considering that most people require the functionality of their hands to do their job and they come from poor communities with limited ability to pay the costs of re-treatment in case of relapse, selecting the correct treatment procedure is of paramount importance. The question is “Does injection has the same effect on improving symptoms and function as surgical procedure does?” Or “Is it a wise therapeutic alternative for this disease?” In this context, this paper is the first attempt to study patients with this disease in the Southeast of Iran to evaluate the effectiveness of these two treatment methods and compare their performance in improving symptoms and functions of patients.

2. Methods

In this study, all patients with clinical symptoms of carpal tunnel syndrome including paresthesia, pain, motor impairment and exacerbation of symptoms at night, who had referred to Orthopedic Clinic of general Hospital of Zabol were recruited in the study. Patients with a clinical suspicion of carpal tunnel syndrome were examined and diagnosis was confirmed based on electrodiagnostic studies. Exclusion criteria included, underlying metabolic diseases like diabetes thyroid diseases, mellitus rheumatoid arthritis, pregnancy, and evidences of associated radiculopathy or neuropathy along with the patient’s intention to abandon the study. After listing the qualifications, patients were enrolled. They were briefed about the goals and asked to sign an informed consent form at the beginning of the study. Then, the demographic and clinical information was collected by the therapist. Using a standard classification system (Boston questionnaire (6) and visual analog scale of pain) (7) patients were severe pains were discarded, and those with moderate and mild pain were divided into two groups and received two different treatments. The first group underwent open surgery. All procedures were performed by a qualified orthopedic specialist. After local anesthesia (Bier Block) and wrapping a tourniquet around their upper arm, patients were operated on (1). The standard skin incision proximal to the wrist was made with an angle toward the ulnar side of the wrist (1). A longitudinal line along the radial axis of the third finger was stretched 2 or 3 cm distal to the transverse carpal fold (1). First, the skin and the subcutaneous tissue and then flexor Retina Colum were released (1). Deep fascia of the forearm, transverse ligament of the wrist and aponeurosis between the thenar and hypothenar muscles were cut without damaging the median nerve and the contents of carpal tunnel were examined (1). The skin was finally sutured with 0-4 nylon (1). Tenosynovectomy and neurolysis were not performed for patients. Then, the wrist was wrapped with gauze and bandages under gentle pressure. Patients were allowed to use the wrist imemdiately to avoid dependent positions. It was explained to the patient that they could remove the surgery coverage after 2 or 3 days at home. The sutures were taken out 10 to 14 days after surgery. If necessary, patients could use wrist splint for 14 or 21 days.

The second group was treated with local injections of triamcinolone. To do so, 2 cc of triamcinolone (Ampul 40 mg) was mixed with 1cc of lidocaine 2%. Finally, 1 cc with a 2-cc syringe and a needle (23) was injected in the valley of the wrist between flexor carpi radialis tendon and palmaris lungous in the median nerve passway at an angle of 45 degrees, and wrist was in full sedentary position in a splint for two weeks (1). BCTQ was used to assess the severity and function at baseline and after a 6- month follow-up (6). The questionnaire consisted of two scales: a Functional Status Scale (FSS) and a Symptom Severity Scale (SSS). The latter consisted of 11 items with multiple-choice answers, which were scored in the range of 1 (mildest) to 5 (most severe). The overall score of symptom severity was computed based on the mean of ratings for all 11 items. The items addressed the clinical areas of CTS symptoms including severity of nocturnal pain, nocturnal awakening frequency elicited by pain, severity, frequency and duration of daytime pain, severity of numbness, weakness and tingling, as well as the severity of nocturnal numbness/ tingling, frequency of nocturnal awakening caused by numbness/ tingling, and difficulty in grasping small objects. The FSS convers eight daily activities implemented by most individuals, which are typically influenced by CTS. The patients evaluated their ability to perform each of these activities on a scale of 1 (lack of difficulty in performing the activity) to 5 (inability to perform the activity). The overall score for the FSS was the mean of the ratings on the eight daily activities.

The visual analog form was also used to assess pain (7). The form consisted of a line 10 cm in length in which zero indicated the absence of pain and 10

indicated severe pain. The patients were asked to mark the form based on the severity of their pain, once for daily pain and once for night pain. The points marked on the line were calculated and their average was considered as the pain intensity. The effect of treatment on variables such as pain, function, and severity of symptoms, ANCOVA and McNemar test were used. We used SPSS software for data analysis (95% confidence interval).

3. Results

In this study, 100 patients with mild and moderate carpal tunnel syndrome were recruited. Participants' disease was confirmed based on their medical history, clinical examination and electrodiagnostic findings. They were divided into two groups of (n=50) and treated with two different treatments: local injections of triamcinolone and open surgery. The mean age of patients was 42.29 years with a standard deviation 9.36. In terms of gender, 93% of participants were female and 7% were male. Table 1 shows patients' demographic information and results of comparison between two groups.

As can be seen, the severity of symptoms in the surgery and injection groups was 2.51 and 2.61 respectively, and the two groups were not significant different in this respect (p = 0.08). However, in the follow-up, the severity of symptoms in the surgery group (1.77) was significantly lower than the injection group (2.62) (p <0.001). The mean severity rating in the surgery group was 2.51 before treatment and 1.77 (29.78%) after treatment. This reduction was statistically significant (p <0.001). However, in the injection group, the severity of symptoms fell from 2.61 to 2.26 (13.6%) which was statistically significant (p <0.001). Therefore, symptom mitigation in the surgical group was higher than in the injection group (p = 0.0001). Before the treatment, the mean limb function was 2.68 in the surgery group and 2.71 in the injection group, and the two groups were not significantly different in this regard (p = 0.5). However, after the treatment, the mean performance score in the surgery group (1.74) was significantly lower than in the injection group (2.58) (p<0.0001). On the other hand, the mean performance of the surgery group before treatment was 2.68 (34.91% reduction), which was statistically significant (p = 0.0001). In the injection group, the mean performance score fell from 2.71 to 2.58, which was statistically significant (p <0.001). However, the decline in performance score of the surgical group was higher than the injection group (p = 0.0001). With regard to the amount of pain before treatment, the mean pain was 5.82 in the surgery group and 5.86 in the group of injection, and the two groups were not significantly different in this regard (p = 0.3). However, after the treatment, the mean pain score in the surgery group (0.63) was significantly lower than the injection group (1.72) (p = 0.0001). On the other hand, the mean pain score in the surgery group before treatment (5.82) fell to 0.63 after treatment (89.09%decline), which was statistically significant (p <0.001). In the injection group, the mean pain score dropped from 5.68 to 1.72, which was statistically significant (69.07 %). However, the pain score reduction in the surgical group was higher than the injection group (p = 0.0001).

Table 1. Patients' demographic information in two groups

variables			Type of treatment		P-value
			Surgery	injection	
sex	female	number	45	48	0.2
		%	90	96	
	male	number	5	2	
		%	10	4	
hand	right	number	28	26	0.7
		%	56	52	
	left	number	22	24	
		%	44	48	
age	mean(SD)		43.52(8.60)	41.06(10)	0.3

4. Discussion

Totally, findings of the study show Symptoms, function and pain were improved in both groups, but the results of surgical treatment were more promising than non-surgical treatments. Most patients in this study were females. The study of Atroshi et al. (8) revealed that CTS was more prevalent in females. The higher prevalence in women could be partially due to hormonal factors. However, in general, it is contended to be associated with tendency and greater frequency of musculoskeletal problems in women (9). Further, it has been posited that higher prevalence of CTS in women is partly due to disparity of carpal tunnel volume between men and women (10). It has also been suggested that hormonal changes influence the onset of CTS in women (11) causing swelling that increases pressure on the median nerve (12). All our patients were housewives used to with high-intensity housework. This is in agreement with the study of Tang et al (13), according to which hand-intensive nature of household chores may be related to the

higher incidence in women. In addition, in the study of Baysal et al, participants were mainly housewives and performed high-intensity housework as well as computer-using clerks (14). In this study, the outcomes of surgery and local injection of steroids in the treatment of patients with idiopathic CTS were evaluated and compared. In evaluating various parameters, we used absolute superiority index in the surgery group so that all indicators in the surgery group were lower than the injection group. The study showed that both groups of patients had improved in terms of the severity of symptoms, function status and the pain after intervention, but patients claimed that surgery had a significant effect on relieving symptoms, improving hand function and reducing pain after 6 months.

The results of this study are in agreement with the study og Ly-phen D et al that the results of this 2- year follow-up by VAS showed more than 20% improvement in paresthesia in 69% of wrists in the surgery group compared to 60% of wrists in the injection group (15).

The results of the study of Faten I Mohamed et al. in 2016 on the comparison of medical treatment of CTS patients with nerve decompression surgery are consisted with our results. After a 6-week follow-up, pain, paresthesia, nocturnal awakening, Tinel test, Phalen, Boston questionnaire, BQ (BCTQ-SSS), functional status (BCTQ-FSS), NCV and EMG were immediately evaluated after treatment. At the outset, a significant improvement was observed in pain, paresthesia, numbness, Phalen's and Tinel tests in both groups. However, the wrist bend was only improved in group A. The difference between the two groups became evident six weeks after the treatment in terms of factors such as tingling, pain, wrist bending, BCTQ-SSS and BCTQ-FSS in group A compared to the baseline. However, in the second group, only BCTQ-FSS improvement was observed. Improvement in normal electro-diagnostic studies was also clearly observed two to six weeks after the treatment. Finally, it was concluded that nerve decompression surgery has more therapeutic effect compared to the medical treatment (16).

As reported in WebMD site, 111 patients with carpal tunnel syndrome were selected, and assigned to two groups, which were treated with local injection of corticosteroids and surgery. Ten weeks after treatment, patients in both groups showed improvements in pain, numbness and other symptoms, but after one-year, in three-quarters of patients injected with methylprednisolone, symptoms relapsed and they turned to surgery. According to their results, most patients undergoing conservative treatment with corticosteroids were more likely to return to their symptoms. Therefore, it seems that injection offers a temporary improvement and it does not leave the effect of surgery in the long term (17).

The results of study's Ren showed both methods were effective in treating CTS. In terms of security, conservative approach to surgery was preferred, but in terms of improvement of performance, symptoms, neuropsychological parameters and cost of care, no significant difference was observed between the two groups (18).

This makes sense the pathogenesis of CTS and the effect of each treatment, injections and surgery, are taken into account. Primary CTS is caused by the compression of the median nerve in the carpal tunnel (CT), especially to its ceiling, the flexor retinaculum. Steroids could counteract some pathogenic mechanisms in CTS (19), including suppression of vascular congestion and/ or synovial swelling, followed by the relief of local ischemia, which reduces pressure inside the CT (19). Theoretically, steroid injection may only offer temporary relief as long as the mechanical restriction is preserved, whereas the section of flexor retinaculum should provide greater space for contents of CT, and therefore resolve the problem.

5. Conclusion

In this study, patients experiencing CTS who underwent median nerve mobilization showed satisfactory improvement in their condition in comparison with those undergoing conventional medical treatment; therefore, for satisfactory results, manual therapy is preferred to conservative management methods for treating patients with CTS.

This study had a number of limitations including the lack of a control group and its relatively small sample size. To achieve more convincing results, it is recommended to conduct a study with larger sample size and longer follow-up with a control group design in the absence of any therapeutic intervention.

Acknowledgments

None

Conflicts of interest

None

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