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Comparison of open surgery versus ultrasound-guided median nerve hydro dissection with Triamcinolone acetonide in the treatment of carpal tunnel syndrome

Mahsa Por-Bozrg[1], Mehrfza Mir[2], Pouyan Ebrahimi[1], Yasaman Mahdizadeh Darban[1], Amirhosein Zohrvand[1], Taha Chartab Mohammadi[3], Shahram Seyfi[1*]

[1]Student Research Committee, Babol University of Medical Sciences, Babol, Iran

[2]Department of Anesthesiology, School of medicine, Babol University of Medical Sciences, Babol, Iran

[3]Student Research Committee, Baqiyatalah University of Medical Sciences, Tehran, Iran

Corresponding author: Dr Shahram Seyfi , Email: ficu_ss@yahoo.com, Phone: +981132238301

Student Research Committee, Anaesthesiology

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Abstract

Introduction: One of the treatments for carpal tunnel syndrome (CTS) is open surgery. Using the median nerve release technique with the help of normal saline under guided sonography with steroid injection is also possible. Due to the limited studies and the uncertainty of the results, this study aimed to compare these methods.

Methods: A single-blind randomized clinical trial was performed on two groups of patients with carpal tunnel syndrome. Forty patients with moderate to severe CTS were randomly divided into two groups of 20 people. One group underwent open Phalen surgery, and ultrasound-guided median nerve hydro dissection with Triamcinolone Acetonide was used for the other group**.** We used the Boston questionnaire scale to measure the severity.

Results: Symptom severity and performance were significantly improved before and after intervention ($p<0.001$ for all). No statistically significant difference was found between the severity of symptoms and the performance of patients in both groups ($p = 0.73$) ($p = 0.38$). Also, age and gender had no significant effect on the severity of symptoms and function at different time intervals ($P>0.05$ for all).

Conclusion: The study results showed that the ultrasound-guided median nerve hydro dissection with Triamcinolone acetonide and open surgery have similar effects. It can be recommended as a suitable alternative to open surgery.

Keywords: Carpal Tunnel Syndrome, Injection, Surgery, Ultrasound-guidance

1. Introduction

CTS is one of the most common oppressive neuropathies (1), which is 2.5 times more common in males (2). Occupational CTS causes a considerable burden on patients compared to all the upper extremities (3). CTS appears following the median nerve stimulation, which passes through the carpal tunnel at the wrist site (4). Symptoms include pain, numbness, tingling, and weakness in the affected arm and hand, increasing during rest (5). Also, test results such as the Phalen test and the tinel sign can help diagnose CTS (6).

Repetitive hand activity, soft tissue tumors, diabetes, and gouts can be some of its risk factors (4, 6). Treatments aim to relieve pressure on the median nerve, including surgical, non-surgical, and different tools (6). Non-surgical methods range from splinting, steroids, activity modifiers, and non-steroidal anti-inflammatory drugs (NSAIDs) to diuretics and vitamin B6 (7). Some studies illustrated that steroid injection under an ultrasound guide leads to more than 90% improvement (8). Also, the surgical method is known as an effective method for the treatment of CTS (9) which generally involves a Common Flexor Tendon (CFT) incision and release of pressure on the median nerve (10).

normal saline under ultrasound guidance, which allows one to make a finer incision than the forthcoming release of the median nerve and reduces the chances of scarring and recurrence. The ultrasound-guided injection has improved by 70 to 90 and even 100% among patients in contrast with open surgery (8).improved by 70 to 90 and even 100% among patients in contrast with open surgery (8).

Therefore, we aimed to compare the effectiveness of two open surgery methods and median nerve release with the help of ultrasound with the injection of normal saline and Triamcinolone Acetonide.

2. Methods

Study design

We used a randomized, single-blind clinical trial on patients with CTS who agreed to participate in this project. The ethical identification from Babol University of medical science was IR.MUBABOL.REC.1400.045. Moreover, a clinical code was gained: IRCT20210307050617N.

Inclusion and exclusion criteria

Patients (20 to 65 years old) with moderate to severe CTS were included in the study. Patients with systemic diseases such as inflammatory joint diseases, diabetes, hypothyroidism, patients with a previous history of CTS surgery, or peripheral nerve lesions of the forearm were excluded. Patients with severe weakness of the palmar or thenar muscles or atrophy of thenar muscles that have been sent directly for surgery were removed from this study.

Sample size

Considering the recommended formulas of Cochran's sample size and (9), confidence interval (CI) of 95%, a power of 80%, precision (d) of 1.5, and standard deviation number one and two of 1.4, 1.6, respectively, 20 samples for each group were obtained.

Interventional therapy and blinding

All patients with suspected CTS were visited by a neurologist and were diagnosed with moderate to severe CTS based on clinical signs, physical examination, and EMG-NCV. The neurologist confirmed the diagnosis of CTS based on three criteria: 1. Sensory disorders such as pain and tingling 2. Functional disorders such as falling equipment 3. An electrophysiological study measuring the median nerve's motor latency and sensory conduction velocity. Before any intervention, the relevant explanations were given to the patients, and their written consent was obtained. They were randomly referred to a surgeon or a pain fellowship for surgical treatment and ultrasound release of the median nerve.

The first group underwent open Phalen surgery by a specific surgeon. In this surgery, the patient's hand was anesthetized locally; then, a 2.5 cm long incision was made 1.5 cm distal to the wrist in the direction of the fourth finger. After removing the adipose tissue and aponeurosis, we released the distal end of the transverse ligament; this ligament was cut longitudinally from the distal to the proximal to see the median nerve the patient's hand was sutured and transferred to the recovery room. In the second group, the median nerve from the forearm to the wrist under the CFT was identified entirely by a pain fellowship anesthesiologist using ultrasound (Sono Ace R7 and Linear probe R15). The ultrasound-detectable block needle (sono-visible needle) was guided directly from the ulnar to the wrist under the CFT. Normal saline with local anesthesia (Bupivacaine) and Triamcinolone Acetonide was slowly injected to isolate the median nerve of the CFT. The nerve was immersed in six cc of the injection compound. The CFT was pierced at several points by the needle tip of the block, and finally, the patient was transferred to the recovery room by pressing on the needle entry site for three to five minutes (Figure 1).

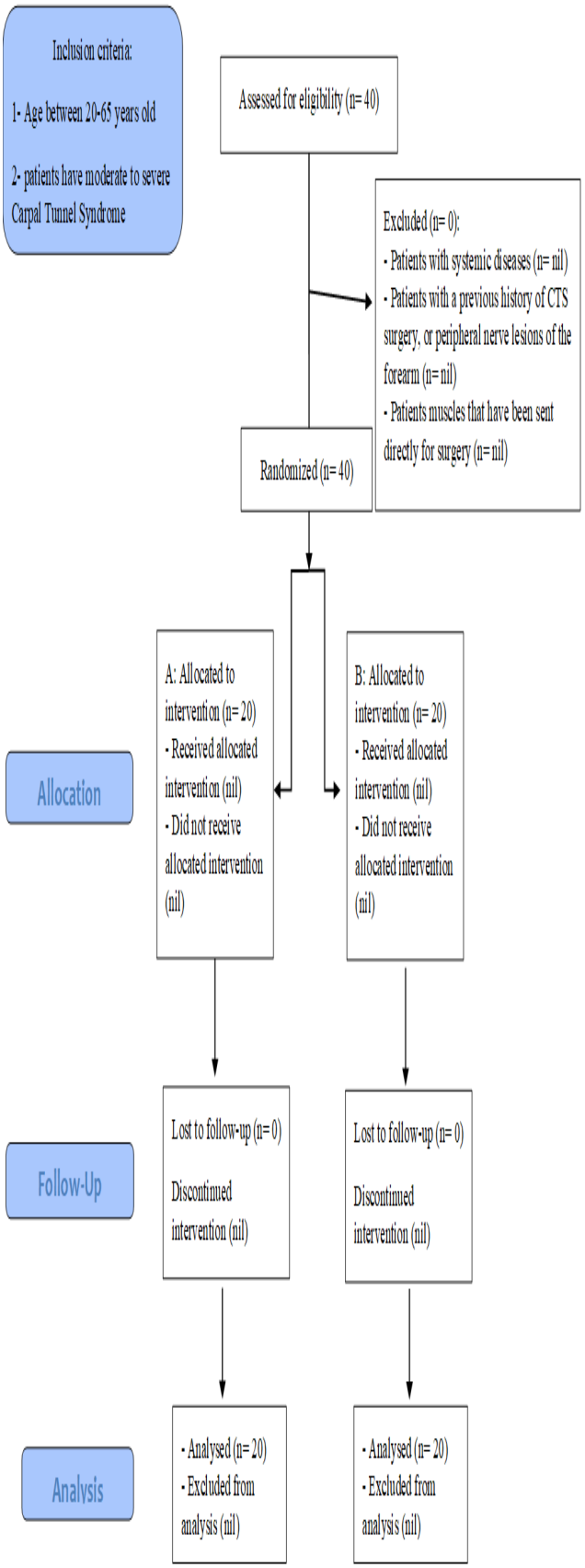


Figure1: CONSORT flow chart

Instruments used

The Boston questionnaire was used to assess patients once before surgery and twice more during one month and three months after surgery (11, 12).

Statistical analysis

SPSS software (version 22.0) was used for data analysis. If necessary, the reported variables were frequency, percentage or standard deviation, and mean. Considering the normality of the variables, we used the chi-score test to find the relationship between two qualitative variables and the t-test or ANOVA test to find the correlation between the qualitative and quantitative variables. A repeated measure test was used to discover the relationship between quantitative variables in various periods and the same time intervals. The significance level was considered less than 0.05.

3.Results

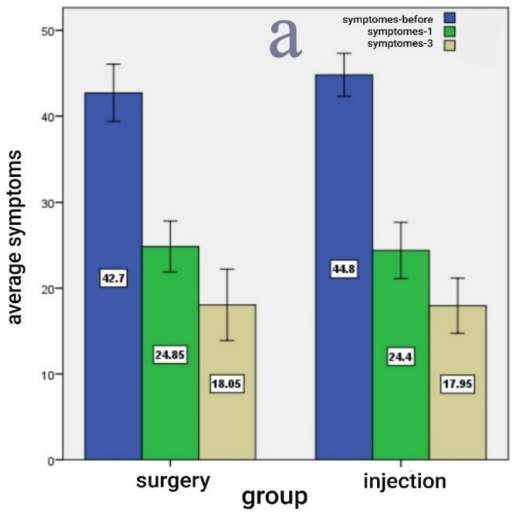
In this study, 40 patients were included in the study divided into two groups of 20: surgery and injection. In the surgical group, the mean age was 48.6 ± 10.3, and 48.0 ± 10.5 in the injection group, which did not show a statistically significant difference (P-value = 0.84). Also, the mean gender (six (30%) male patients in the surgical group and seven (35%) patients in the injection group) did not show a significant difference between the two groups (p = 0.73).

In the surgery and injection groups, sensory symptoms were not significantly different before and after the interventions (P> 0.05 for all). Also, in the examination of performance, although the injection group had a higher average score, this difference was not significant (P> 0.05 for all) (Table 1).

Table 1: Comparison of the severity of sensory symptoms in the two groups of surgery and injection at different times based on the Boston questionnaire scale

Variables		group		P-value
		surgical	injection	
Severity of sensory symptoms	Before the intervention	42.7 ± 7.1	44.8 ± 5.3	0.30
	One month after the intervention	24.8 ± 6.3	24.4 ± 6.9	0.83
	Three months after the intervention	18.0 ± 8.8	17.9 ± 6.8	0.96
Performance	Before the intervention	30.9 ± 5.4	32.2 ± 3.6	0.40
	One month after the intervention	18.4 ± 5.3	18.9 ± 4.9	0.78
	Three months after the intervention	13.9 ± 6.8	16.6 ± 5.3	0.40

Next, we compared the difference between the mean of the Boston questionnaire based on the different times of the study. This evaluation was done once for the severity of sensory symptoms and once for performance. As a result of our intervention, we found a significant relationship in each of the studied groups separately (P<0.001 for all), indicating that both methods effectively reduce both the performance and intensity of sensory symptoms. Although our intervention was significant in each of the surgery and injection groups separately, there was no significant relationship between the two intervention groups (severity of sensory symptoms (P = 0.73) and performance (P = 0.38)) (Figure 2).



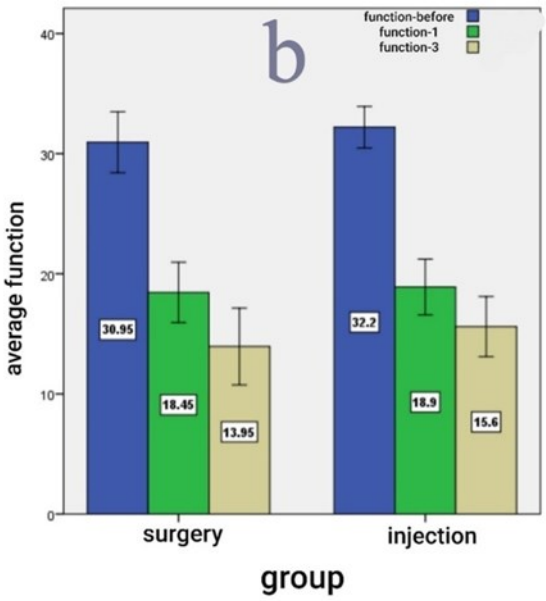


Figure 2: Comparison of our intervention in each of the groups separately. a: Assessing the severity of sensory symptoms in each group of surgery and injection based on Boston questionnaire scores. b: Examining the performance based on the scores of the Boston questionnaire in each of the surgery and injection groups.

Discussion

With the advancement of technology and the creation of new techniques for treating carpal tunnel syndrome, and sometimes due to the contraindications of surgery in patients or their preference to perform minimally invasive procedures, it is challenging for doctors to choose a treatment method. Additionally, the fact that this disease is one of the most debilitating and expensive diseases on the upper limbs, leads to wasted work days, and is considered one of the leading causes of employee damage costs (3) makes it essential to choose the proper treatment.

The purpose of this study was to compare the effectiveness of open surgery with ultrasound freeing of the median nerve using normal saline and triamcinolone acetonide injections. The results based on clinical criteria were also compared in the short term. When we evaluated the severity of symptoms and functional status in the surgery and steroid injection group, we observed favorable improvements after treatment in all clinical parameters in the periods studied.

Also, by comparing these parameters in these two methods, we found that both steroid injections and open surgery were effective, but neither is superior in the short term. Also, in a similar study, Gurcay et al. concluded that in the short term, there was no difference between topical steroid injection and open surgery regarding clinical and electrophysiological outcomes (9). Therefore, our study assessed the severity of symptoms and function between the two groups in the three time periods before the intervention, one and three months after. The findings indicate a similar reduction in symptoms' severity and improving the level of function at different time intervals between the two groups.

Close to a study by Xu et al. found that short-term corticosteroid injections discouraged pressure on the nerve, mainly due to limited inflammation inside and outside the canal. Therefore, they have the same results in short -term open surgery regarding symptom severity and function (13). According to Wong et al., corticosteroid injection is one of the treatments for patients with mild to moderate carpal tunnel syndrome. On the other hand, they found corticosteroid injections not recommendable for patients with severe symptoms (14). Guo et al. concluded that endoscopic surgery with corticosteroid injection three months after surgery could improve the sonographic and electrophysiological parameters of endoscopic surgery without corticosteroid injection (15). In the present study, surgical treatment and corticosteroid injection were evaluated separately, improving patients equally.

According to Fried's study, ultrasound-guided injection with median nerve hydroneurolysis is a safer method than repeated open surgery performed in the office (8). Moreover, Celik et al. concluded that surgery was more appropriate than long-term steroid injections for treating carpal tunnel syndrome in the long term (16). Yung et al. mentioned the therapeutic effects of median nerve hydrodisection for mild to moderate CTS (17). Karadas found that injections of Triamcinolone Acetonide and Procaine HCl were more effective than injections of placebo at two and six months after treatment. There was no difference between injections of this drug in terms of clinical and electrophysiological evaluations in treating CTS (18). The results of this study were in line with the present study's findings.

It should be noted that in the present study, the follow-up period of patients in terms of the recovery process was up to three months after the intervention. There was no significant difference between the surgery and injection groups. However, in the case of a more extended period, the surgical group would have a better result than the injection group. Therefore, more studies are needed at longer intervals.

Additionally, this study had limitations. Electrophysiological components were not examined in the follow-up, and the cross-sectional area of the median nerve was not examined under CFT, which was one of the new criteria for investigating CTS involvement.

Conclusion

According to the results, the release of the median nerve with the help of ultrasound by injecting normal saline and Triamcinolone Acetonide, as well as open surgery, had similar effects. However, the injection can be recommended as a suitable alternative to open surgery since it is an outpatient method with low cost, no complications, a shorter rehabilitation period, and does not cause scarring. Especially in patients who do not have surgical indications or, for various reasons, have surgical contraindications, using injection and ultrasound would be a great chance to release the burden. It can also be used in patients who have had a surgical procedure and have recurrent CTS symptoms. The study results can be used to select the appropriate treatment for patients with carpal tunnel syndrome to decrease additional costs and side effects.

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Conflict of Interests

There was no Conflict of Interest.

Authors' contribution:

Mahsa porbozrg: Conceptualization, Methodology, Software, Investigation, Writing - Review & Editing, Data curation / **Pouyan Ebrahimi:** Writing - Review & Editing, Writing - Original Draft / **Yasaman Mehdizade**: Writing - Review & Editing, Writing - Original Draft / **Mehrfza Mir:** Writing - Review & Editing / **Amirhosein Zohrvand:** Conceptualization, Methodology, Software / **Taha Chartab Mohammadi:** Review & Editing / **Shahram Seyfi:** Writing - Original Draft, Writing - Review & Editing, Conceptualization, Supervision

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