



Modified mini-incision surgery for carpal tunnel syndrome: Results of 131 interventions

Carpal tunnel syndrome surgery

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Abstract

Aim: The aim was the presentation of results from 131 interventions in which a quick and practical modified surgical approach was applied in carpal tunnel syndrome surgery. **Material and Method:** In total, 131 surgical interventions were made in 121 cases. 22 cases were male, 99 cases were female. Boston Carpal Tunnel Syndrome Questionnaire scores were obtained on the postoperative 12th-14th day and compared with the preoperative scores. All cases were performed with local anesthesia. In all cases, surgical equipment consisted of one no-15-blade, one automatic retractor, and one 45 cm prolene 3-0. **Results:** According to EMG results, 71 patients had severe, 49 patients had moderate, and 11 patients had moderate-mild carpal tunnel syndrome. The average time for the surgery was 7.2 minutes. During surgery, one automatic retractor was used, and manipulations that shorten the time of surgery and increase surgical safety have been described. The average incision length was 1.5-2 cm. Subcuticular skin suture was not performed. The stitches were removed on the 12th postoperative day. Seven cases presented wound site inflammation. Relapse in the latter course was not encountered in any case. **Discussion:** The method described as a modification of mini-incision surgery is thought to be reliable, comfortable, and cost-effective. Use of an automatic retractor considerably shortens surgical time and facilitates surgery. Not performing subcuticular suture reduces the probability of relapse. In cases with a high risk factor for infection, treatment of the wound site requires further care.

Keywords

Carpal Tunnel Syndrome; Flexor Retinaculum; Median Nerve; Carpal Tunnel Surgery

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Introduction

Carpal Tunnel Syndrome is the most common peripheral neuropathy. Symptomatology occurs due to median nerve compression under the flexor retinaculum (FR) which is located at the wrist level. It is diagnosed more frequently among people having diabetes mellitus (DM), uremic and collagen tissue diseases as well as during pregnancy and in those who use their wrists too much [1,2]. The syndrome is diagnosed among women 3-10 times more than among men [3,4]. Symptomatology, which often increases at night, includes awakening paresthesia, motor deficits, or atrophy in muscles which are innervated by the median nerve. The diagnosis is confirmed by EMG testing in the presence of clinical findings. The use of NSAID, corticosteroid injections, and wrist splints can be considered in cases with mild clinical signs. The cases that cannot be treated conservatively are recommended for surgical intervention.

A variety of techniques have been defined in the surgical treatment of carpal tunnel syndrome. The common purpose of all techniques is the removal of the compressive effect on the median nerve by opening the flexor retinaculum (FR). In this study, we aimed to demonstrate that the modified mini surgical incision method is less invasive and results in shorter surgical times.

Material and Method

This study evaluates surgical interventions applied between 2013-2017 to 121 patients, with a total of 131 interventions (73 right, 58 left), using the mini-incision method. All cases were evaluated by EMG examination and Boston Carpal Tunnel Syndrome Questionnaire (BCTSQ) scores. Antiaggregant medication due to cardiovascular disease was not discontinued before or after surgery (21 patients).

The daily wound dressing, amoxicillin-clavulanate antibiotherapy, NSAID, and staphylin pomade treatment for skin incision were given for three days in the postoperative period. It was suggested that an arm sling should be used for two days. Stitches were removed after surgery on 12-14th days. BCTSQ scores were obtained at the 12th-14th day, and at the 12th month. The results were compared with the preoperative scores.

Ethics committee approval was obtained from Ahi Evran University Clinical Research Ethics Committee.

Statistical Analysis

The data were analyzed using Statistical Package for the Social Sciences-Version 22.0 (2013, IBM Corp., Armonk, NY, USA). Standard deviation results were compared in each group.

Surgical Method

15 minutes before entering the local surgery room, 4 ml of jetokaine was injected, approximately 1 cm to the superior and inferior of wrist line for local anesthesia. In all cases, one no-15-scalpel was used for skin incision and to cut the FR. The automatic retractor was used as skin retractor.

The skin incision was performed from the midline to the palmar surface, and its length was 1.5-2 cm. Immediately afterward, an automatic retractor was placed and the FR revealed. The FR was incised vertically in the midline. At this time, it was ensured that the automatic retractor was opened as much as possible,

that the FR was stretched well, and that the incision could easily be seen on the FR to open the median nerve. Then, the FR was incised from the lower surface on the median nerve toward inferior and superior, in which the back part of scalpel faced the median nerve. In the meantime, the manipulation of the automatic retractor upward and downward allowed the upper and lower edges of the FR to be seen under the skin incision (Figure 1). Reduction of resistance to the cutting signaled that the incision had reached the upper and lower edges of the FR. When incision resistance ended, care was taken so that the skin incision length was not increased (Figure 2). After cutting of FR ended in superior and inferior, the automatic retractor was re-opened by placing it under two cut leaves of the FR over the median nerve (Figure 3). By this manipulation, the edges of the FR were compressed and blunted. Besides, this manipulation ensured that the cut edges of the FR did not re-adhere later. At this time, if required, possibly subcutaneous bleeding points were stopped with bipolar coagulation. The skin incision was stitched with 45 cm, 3-0 prolene and the operation was terminated.



Figure 1. Upward and downward manipulation of the automatic retractor provides a safe surgical corridor under the flexor retinaculum (FR), preventing a more extended skin incision.



Figure 2. In the safe corridor under the FR, cutting is continued to the borders.



Figure 3. Opening the automatic retractor beneath the FR incision reduces bleeding and helps to blunt the edges of the FR and hence keep the incised edges of the FR from subsequent re-adherence.

Results

According to EMG results, 71 cases had severe, 49 cases had moderate, and 11 cases had moderate-mild carpal tunnel syndrome. 28 of these cases had moderate, and 9 cases had mild-moderate involvement that could not be treated conservatively and were operated.

22 of the cases were male and 99 were female. The mean age of cases was 53.17 (32-76; std dev.:10.97). The most common symptom was complaint of paresthesia which is so severe that it awakens cases at night. 37 cases had diabetes mellitus and 4 cases had rheumatoid arthritis in their medical history. Case demographics are shown in Table 1.

The average duration of surgery was found to be 7.2 minutes from the skin to skin. The use of bipolar was required in 47 cases for bleeding control from the skin. Since the FR was not opened to the desired extent in 16 cases, an excision of approximately 0.5 cm was performed from edges. All of the cases were discharged immediately following the operation.

In one case with severe diabetes mellitus and rheumatoid arthritis, the incision was re-sutured because of an opening of the skin incision. After 12 days, the stitches were removed. In seven cases, anti-inflammatory treatment was extended for another week after redness and pain were experienced in the skin incision area. Long-term follow-up of 87 cases could be evaluated; none of the cases had meaningful carpal tunnel syndrome related symptoms. Average follow-up time was 12 months (range 7-47). Recurrence was not encountered. Preoperative and postoperative BCTSQ scores and additional conditions are shown in Table 2. Comparative BCTSQ results of the cases according to age group are shown in Table 3.

Discussion

Various techniques have been defined in the literature for car-

Table 1. Patient demographics

Patient Demographics	
Gender	
Women	99
Men	22
Median duration symptoms	21 months
Dominant hand	Right: 97 Left: 24
Postoperative Complications	Inflammation: 7 Re-suturation: 1
Recurrence	0 / 131

Table 2. Preoperative EMG results, Boston questionnaire scores and additional conditions. (F: functional, S: symptomatic, DM: diabetes mellitus, RA: rheumatoid arthritis) *(average time:12 months)

EMG Results	Boston Q Score (preoperative) n=131 F / S	Additional Conditions	Boston Q Score (postoperative)* n=116 F / S
Severe n=71	3.49 / 3.51 Mean: 3.50	DM:21 RA:2	1.53 / 1.49 Mean:1.51
Moderate n=49	3.05 / 3.10 Mean: 3.07	DM:14 RA:1	1.49 / 1.52 Mean: 1.51
Moderate-Mild n=11	2.60 / 2.50 Mean: 2.56	DM:2 RA:1	1.24 / 1.19 Mean: 1.21

Table 3. Comparative BCTSQ results of the patients according to age group. (S: severe, M: mild, M.M: mild-moderate, Avg: average, Preop: preoperative, Postop: postoperative, BCTSQ: Boston Carpal Tunnel Questionnaire Score, σ: standard deviation)

Age Interval	Age <60 (n=85) (Avg. Preop. BCTSQ)	Age <60 (n=71) (Avg. Postop. BCTSQ)	Age >60 (n=23) (Preop. BCTSQ)	Age >60 (n=18) (Postop. BCTSQ)
Women	S: 3.52 (σ:2.84)	S: 1.57(σ:2.83)	S: 3.57 (σ:1.49)	S: 1.46 (σ:2.75)
32-76	M: 3.03 (σ:2.36)	M: 1.50(σ:2.87)	M: 3.09 (σ:2.24)	M: 1.42 (σ:2.14)
(σ: 10.17)	M.M: 2.61 (σ:1.50)	M.M: 1.30(σ:2.50)	M.M: 2.66 (σ:3.06)	M.M: 1.11 (σ:1.53)
Age Interval	Age <60 (n=11) (Avg.Preop.BQS)	Age <60 (n=10) (Postop.BQS)	Age >60 (n=11) (Preop.BQS)	Age >60 (n=10) (Postop.BQS)
Men	S: 3.59 (σ:1.00)	S:1.34 (σ:1.89)	S: 3.56 (σ:1.30)	S: 1.60 (σ:3.78)
39-71	M: 3.06 (σ:1.63)	M: 1.41 (σ:3.58)	M: 3.15 (σ:1.15)	M: 1.48 (σ:1.53)
(σ: 7..99)	M.M: 2.63 (σ:0)	M.M: 1.45 (σ:0)	M.M: 2.54 (σ:2.0)	M.M: 1.22 (σ:3.54)

Table 4. Comparative results of previous studies. (F./S: functional/symptomatic)

	Surgery Method	Preop. BCTSQ F./S.	Postop. BCTSQ F./S.	Average Follow-up Time	Complications
Ugurlu et al [19]	Open	?	1.49 / 2.18	1 month	Hematoma: 1 Infection: 2
Ugurlu et al [19]	Endoscopic	?	1.28 / 2.08	1 month	Hematoma: 2
Atci et al [20]	Open (distal to pillar) (n=35)	2.04 / 3.22	1.42 / 1.60	6 months	Paresthesia: 3 Pain: 3
Atci et al [20]	Open (proximal to pillar) (n=35)	2.15 / 3.44	1.38 / 1.40	6 months	Pain: 6
Penas et al [21]	Open (n=?)/ Endoscopic (n=?) N=60	2.4 / 2.7	1.50 / 1.50	12 months	0
Murthy et al [22]	Mini-open (n=70)	?	0.85 / 1.17	4,5 months	1 (Failure) Recurrence ?
Murthy et al [22]	extended release (n=64)	?	0.83 / 1.17	10 months	Infection: 2
Heybeli et al [23]	Open (n=44)	3.3 / 3.4	1.40 / 1.30	6 months	?
Atroshi et al [24]	Open (n=63)	2.37 / 3.08	1.19 / 1.38	12 months	1 recurrence
Atroshi et al [24]	Endoscopic (n=63)	2.37 / 3.15	1.25 / 1.40	12 months	2 recurrence
Asan (This study)	Mini-open (n=131)	3.25 / 3.27	1.48 / 1.47	12 months	Infection: 1

pal tunnel syndrome surgeries, including endoscopy assisted surgery [5], rope cutting surgery, and mini-incision surgery [6-8]. In the traditional surgical procedure, a wide incision is made in the wrist area and the upper and lower bounds of the FR are revealed completely.

In the technique we applied, an incision of approximately 1.5-2 cm is made. Placement of the automatic retractor immediately after incision facilitates surgical intervention and provides a safe surgical corridor. It also provides the stretching of the FR before incision. Manipulating the handles of the retractor upward and downward creates a safe corridor between the FR and the median nerve that the scalpel can safely access. The automatic retractor also provides bleeding control during surgery, and noone is needed to assist with the retractor. Placement and opening of the automatic retractor under the FR leaves blunts the wound edges. This maneuver may prevent subsequent re-adherence of the edges.

It is sufficient to use just one piece of the no-15-scalpel during the surgical procedure. It is thought that subcutaneous suture may cause the FR edges to approach each other, causing recurrence. One 45 cm, 3-0 prolene is sufficient for skin suturation. Although various surgical methods have been defined in the literature, none has significant superiority over the others (Table 4). Complication rates of these methods are similar; the most frequently identified post-surgery complication is wound infection [9]. Median nerve injury is a very rare complication during carpal tunnel syndrome surgery [10]. All the defined techniques are sufficient to release the median nerve. However, it is thought that new techniques will enable a more comfortable and cost-effective surgery.

One of the most frequently encountered complications following carpal tunnel syndrome surgery is wound site infection. In cases of advanced age and in cases with systemic diseases like diabetes mellitus or rheumatoid arthritis, healing of the wound site takes longer and the risk of encountering wound site infection is higher. A significant correlation has been made between a high HbA1c value and the frequency of encountering wound site infections [1]. Apart from diabetes mellitus, age, male sex, obesity, tobacco and alcohol use, chronic kidney and liver diseases, and depression are among other risk factors associated with infection [11]. It has been shown that preoperative antibiotic use is not effective in preventing postoperative infection [12]. The studies that have been done reveal that the rate of postoperative wound site infections can be as high as 0.36% [13]. Symptoms of inflammation, such as redness and pain in the wound site, can be encountered at a rate of 9% [14].

In cases operated for carpal tunnel syndrome, the rate of recurrence was found to be twice as high for cases previously diagnosed with DM [11]. While carpal tunnel syndrome is encountered more frequently in DM cases, DM also plays a role in recurrence. The effectiveness of the surgical method utilized is also a risk factor.

Some studies have found recurrence rates to be between 2.6-7% following endoscopic carpal tunnel surgery, which has lately become more popular [15,16]. The complaint of numbness was found to have continued for longer in cases who underwent endoscopic surgery [17]. Even surgical techniques described as minimally invasive have been found at fault as the FR undergoes fibrosis again after incomplete release following surgery [18]. When the open surgical techniques described in the literature were reviewed, it was seen that the FR was completely uncovered and that it was incised with quite a large incision. Having a large incision may delay the course of wound healing as well as interfere with the comfort of the patient. It has been shown that the FR can be completely incised with a 1.5cm incision using the technique we have described. With the described incision technique, methods to avoid damage to the median nerve have also been stated.

Performing a longitudinal incision at the level of the wrist is thought to delay wound healing in this active region and prevent the edges of the wound from closing. Another method is to reach the FR with a transverse incision at the wrist level. However, we think that it will be difficult to reach the upper and lower borders of the FR with this method, that it may result in incomplete release, and that the surgery will be inadequate and

increase the risk of recurrence.

On the other hand, we think that surgery with the endoscopic method is not cost-effective, that it requires experience in endoscopy use, prolongs the surgical duration, presents a higher risk of median nerve injury, and when compared to the method we have described, there is not a significant difference between the sizes of incisions. With the method we have described, recurrence was not encountered in any of the cases being followed-up.

Conclusions

We believe that the described technique considerably shortens the duration of surgery; is a more cost-effective method; creates a safe surgical corridor to enable an effective surgery; and uses fewer consumables. Besides, this method is comfortable for the patients and may prevent re-adherence of the FR edges and recurrence of carpal tunnel syndrome.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

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