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Araştırma / *Research Article*

The Effect of Tenosynovectomy on Patient Outcome in Carpal Tunnel Syndrome Surgery

Ahmet Levent Aydın
Melih Üçer

Karpal Tünel Sendrom Cerrahisinde Tenosinovektominin Hasta Sonuçlarına Etkisi

ABSTRACT

Objective: *Carpal tunnel syndrome (CTS) is estimated to be the most frequently seen mononeuropathy, needing surgical intervention. Its prevalence is known to range between 1, and 3 percent. The components contained in this tunnel are the median nerve, four deep digital flexor tendons, as well as four superficial flexors and the tendon of flexor pollicis longus. Between the tendons and bursae an anatomical structure is present called subsynovial connective tissue (SSCT). SSCT absorbs and transmits stress between tendons and the median nerve and it functions as a scaffold for vascular elements. To find out the role of compression or pathologic proliferation of SSCT in the pathogenesis of CTS, we aimed to conduct a study about the surgical technique of this pathology and compared the long- term results of patients operated with or without SSCT excision in our neurosurgery clinic.*
Method: *Between 2003 and 2019 we operated 1279 patients at our neurosurgery clinic. Among them 250 patients who had SSCT excision (syn+) were chosen and they were compared with other 250 patients operated without SSCT excision (Syn-).*
Results: *All patients were evaluated preoperatively and 12 months postoperatively based on the results of Boston Carpal Tunnel Syndrome Questionnaire. When pre-, and post-operative results were compared, we didn't observe a statistically significant intergroup difference.*
Conclusion: *Although our primary goal in patients in whom we performed excision of tenosynovium is to relieve the median nerve by increasing decompression, we observed that there was no difference between the two groups in this large-scale study. We think that only liberation of the transverse carpal ligament during surgery will be sufficient.*

Keywords: *carpal tunnel, median nerve, subsynovial connective tissue*

ÖZ

Amaç: *Karpal Tünel Sendromunun (KTS) en sık görülen ve cerrahi müdahale gerektiren mononöropati olduğu tahmin edilmektedir. Genel prevalansının % 1-3 olduğu bilinmektedir. Bu tünelin bileşenleri şunlardır: median sinir, dört derin fallanx fleksör tendonu, ayrıca dört yüzeysel fleksör ve fleksör pollicis longus tendonu. Tendonlar ve bursa arasında bir yapı mevcuttur. Subsinovyal bağ dokusu (SSBD) olarak adlandırılır. SSCT, tendonlar ve medyan sinir arasındaki stresi emer ve iletir ve vasküler elemanlar için bir iskele görevi görür. KTS patogenezinde SSCT'nin kompresyonunun veya patolojik proliferasyonunun rolünü bulmak için bu patolojinin cerrahi tekniği ile ilgili bir çalışma yapmayı amaçladık ve nöroşirürji kliniğimizde SSBD eksizyonu olan veya olmayan hastaların uzun dönem sonuçlarını karşılaştırdık.*
Yöntem: *2003 ile 2019 yılları arasında nöroşirürji kliniğimizde 1,279 hastayı ameliyat ettik. Tüm hastalar aynı kıdemli beyin cerrahı tarafından ameliyat edildi. Bu hastalardan sinovektomi (syn+) olan 250 hasta seçildi ve bunlar sinovektomi (syn-) yapılmadan ameliyat edilen diğer 250 hasta ile karşılaştırıldı.*
Bulgular: *Tüm hastalar ameliyat öncesi ve ameliyat sonrası 12. ayda Boston Karpal Tünel Sendromu Anketi sonuçlarına göre değerlendirildi. Preoperatif ve postoperatif sonuçlar karşılaştırıldığında istatiksel olarak anlamlı bir farklılık belirlenemedi.*
Sonuç: *Tenosinovyum eksizyonu yaptığımız hastalardaki öncelikli amacımız dekompresyonu arttırarak median siniri rahatlatmak olsa da yaptığımız bu geniş ölçekli çalışmada her iki grup arasında fark olmadığını gözlemledik. Cerrahi sırasında yalnızca transvers karpal ligamanın serbetleştirilmesinin yeterli olacağını düşünmekteyiz.*

Anahtar kelimeler: *median sinir, karpal tünel, subsinovyal bağ dokusu*

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Melih Üçer
S.B.Ü. Kanuni Sultan Süleyman Eğitim ve Araştırma Hastanesi
Beyin ve Sinir Cerrahisi Kliniği
İstanbul - Türkiye
melihucer@hotmail.com
ORCİD: 0000-0002-2004-2991

A. L. Aydın 0000-0002-6646-4858
Koç Üniversitesi Hastanesi
Beyin ve Sinir Cerrahisi Kliniği
İstanbul - Türkiye

INTRODUCTION

Carpal tunnel syndrome (CTS) is estimated to be the most frequent mononeuropathy, needing surgical intervention. It is known to have a general prevalence of 1-3% [1-3]. Carpal tunnel is a fibro osseous tunnel, located at the palmar side of the wrist. The carpal tunnel is a canal formed by the carpal bones and the transverse ligament. It is formed by carpal bones dorsally and laterally, and by the flexor fibrous retinaculum (transverse carpal ligament) ventrally [4,5].

The components of this tunnel are: The median nerve, four deep phalanx flexor tendons, as well as four superficial flexors and the tendon of flexor pollicis longus. A tissue of ulnar bursa envelops the deep and superficial finger flexors, and a radial bursa envelops the pollicis longus tendon. Between the tendons and bursae a structure is present. It is named as subsynovial connective tissue (SSCT). SSCT absorbs and transmits stress between tendons and the median nerve and it functions as a scaffold for vascular elements [1,6].

Some authors suggested that chronic compressive and repetitive motion of the wrist might result in ischemic and reperfusion episodes on the median nerve and in turn, play an important role in the etiology of CTS. Some other authors claimed that the shearing forces of SSCT, a specific tissue for this anatomic region, might cause injury on the median nerve [7-10]. To find out the role of compression or pathologic proliferation of SSCT in the pathogenesis of CTS, we aimed to conduct a study about the surgical technique of this pathology and compared the long term results of patients operated with or without SSCT excision in our neurosurgery clinic.

MATERIAL and METHODS

Between 2003 and 2019 we operated 1279 patients under the diagnosis of carpal tunnel syndrome at our neurosurgery clinic. All the patients were operated by the same senior neurosurgeon. The preoperative and postoperative documentary of the patients were analysed retrospectively. Of these patients, 250 patients with synovectomy (syn+) were chosen and they were compared with other 250 patients operated without synovectomy (syn-).

The criteria for the operation of all patients were as follows: Positive Phalen and Tinel provocation tests, sensory deficit and tingling at the median nerve innervation zone, numbness and pain at the lateral 3 fingers especially at recumbent position, waking the patient up at least once per night. Motor deficit at the opponens pollicis and flexion of the 3 radial fingers were checked preoperatively and postoperatively but patients with normal muscular strength were not excluded. Similarly, thenar atrophy was checked, for but was not obligatory

Electromyographic (EMG) results were important for the patient selection. A patient with moderate or severe denervation of the median nerve was chosen to be a candidate for surgery. Changes in sensory and motor median nerve velocity and amplitude depression, latency prolongation were the criteria for the EMG alterations, leading to surgery. Patients with normal EMG or minimal EMG changes were followed with conservative treatment.

All the patients were analysed according to Boston Carpal Tunnel Syndrome Questionnaire (BCTQ). This most widely used questionnaire for carpal tunnel syndrome, published by the Boston group [11]. In this questionnaire, there are 11 questions for symptomatic status,and 8 questions for functional status. For the symptomatic status, 11 points were evaluated to be asymptomatic, 12 to 22 to be mild, 23-33 points moderate, 24-44 points severe and 45-55 points very severe. 8 points were evaluated according to the functional status, questions ranked from 1 to 5 According to this measurement, 8 points were asymptomatic, 9-16 were mild, 17-24 were moderate, 25-32 were severe and 33-40 were very severe.

All patients were questioned preoperatively and postoperatively by the same senior surgeon, according to the BCTQ. All answers were to be concerned with the symptoms within a typical period of 24 hours, for the last two weeks. Although the postoperative follow up was conducted at postoperative 1st, 3rd, 6th and 12th months, only the 1st year values were compared with the preoperative. Because we think that full recovery postsurgically and tissue remodelling occurs between 6-12 months after CTS surgery. All the patients were referred to a physical therapy clinic 3 months after the surgery.

Surgical procedure

The patients were operated at one side under regional intravenous anesthesia (RIVA). The surgical incision extended from the distal wrist crease to the Kaplan's line, on the tenar crease. The transverse carpal ligament was dissected sharply by the scalpel carefully without injuring the median nerve nor the motor branch of the 1st finger. After identifying the nerve, the flexor tendons were explored. In the synovectomy group (Syn+), the tenosynovial tissue surrounding the flexor tendons was dissected from the tendons and excised totally (Figure 1). In the non synovectomy group (Syn -), the tenosynovial tissue was left intact. But in cases where pannus formation or tenosynovitis with exuda collection was observed, synovium tissue was excised, for pathological examination and these cases were included in the syn+ group (Fig 2). Particularly, in cases where the pressure and cyanosis of the median nerve caused by the transverse carpal ligament was obseved, no synovial tissue excision was performed. (Fig 3). All the cases were closed by interrupted sutures and were left splinted for at least 1 week after the operation without opening the wound dressing. The operated hand was advised to be kept in elevation for 1 week. Preoperative 1 gram cephalosporin was used for infection prophylaxis. The patients were discharged the same day of the operation and NSAID drugs and oral sulbactam ampicillin for 5 days were prescribed.

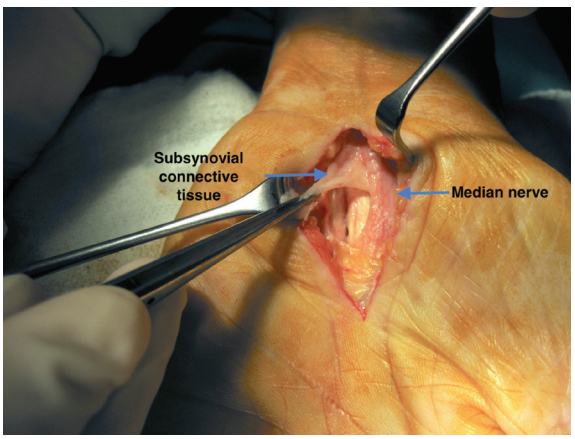

Figure 1. Excision of the synovial tissue after identification of the median nerve.

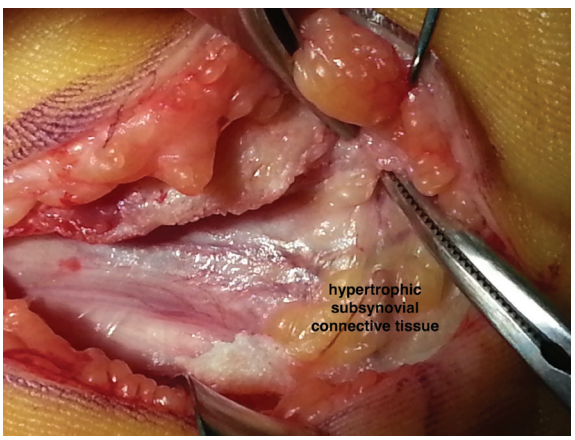

Figure 2. Pannus formation of the synovial tissue convinced the surgeon for excision of this tissue.

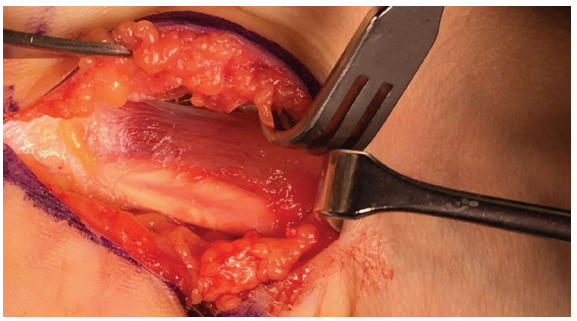

Figure 3. Cyanosis of the median nerve, caused by the pressure of the transverse carpal ligament.

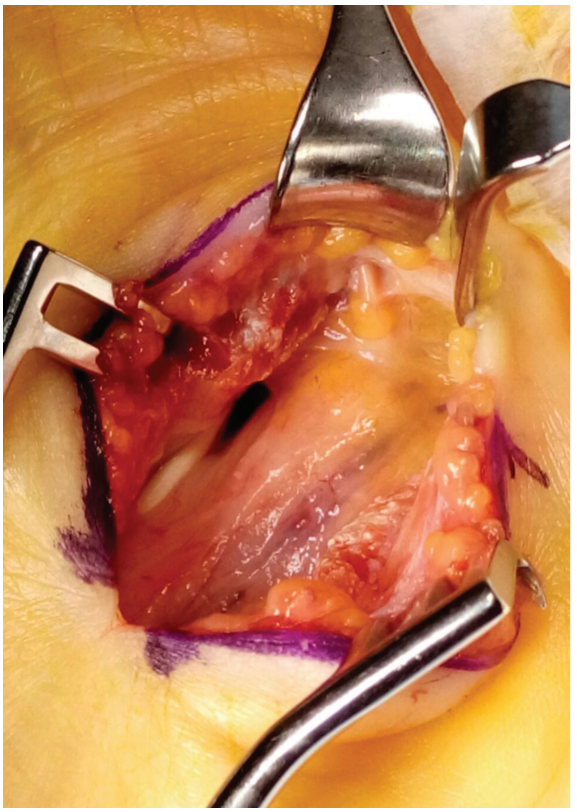

Figure 4. Intraoperatively explored motor nerve branch innervating the 1. finger.

Table 1.

Patient group	Number of patients	Preoperative BCTQ symptomatic scale	Postoperative BCTQ symptomatic scale	Preoperative BCTQ functional scale	Postoperative BCTQ functional scale
Synovectomy +	250	43.6	18.7	31.4	16.2
Synovectomy -	250	42.1	18.1	30.4	15.7

RESULTS

All the patients were evaluated preoperatively and 12 months postoperatively according to the results of BCTQ (Table 1). The mean preoperative BCTQ values of the patient's with and without synovectomy were 43.6± 4.1 and 42.1±2.2 (p=0.11) and postperative BCTQ values were 18.7±2.5 and 18.1±1.5 (p=0.32), respectively. Also preoperative and postoperative BCTQ functional values did not differ significantly between the patient's with and without synovectomy (p=0.07 and p=0.16 respectively).

Non of the patients were reoperated. No motor nerve deficit nor additional paresthesia, was observed. In all the cases, motor nerve branch of the pollicis was documented by intraoperative photograph when explored (Figure 4). Postoperative infection was not seen.

27 patients in group 1 (syn +) and 19 patients in group 2 (syn -) were dependent gabapentin medication for an average of 5 months because of intractable neuropathic pain, not relieved with spints and nonsteroid antiinflamatory medicine.

DISCUSSION

Carpal tunnel syndrome is the most common entrapment neuropathy. Although the incidence in the general population is 3.8% [1-3], the highest incidence is among middle-aged and elderly women [4]. However, the The etiology of idiopathic carpal tunnel syndrome, which accounts for 50% of all CTSs, has not been fully elucidated [12].

Although the main approach in the treatment of CTS is conservative treatment, surgical intervention may also be needed. However, the surgical approach is not a definitive solution for some patients, and it is observed that the complaints continue in 25% of the patients [1,25].

In the studies, it is estimated that, any lesion that affects SSCT tends to narrow the transverse cross-sectional diameter of the carpal canal and may cause compression neuropathy [7] and thickening of the synovial connective tissue may be one of the etiological factors of the carpal tunnel syndrome. This tissue thickening, which is responsible for the etiology, has been shown to be non-inflammatory in histological studies [1,13-15].

In the findings found by Ettema et al. in 2004 and later confirmed by Zhao et al. in 2007, it was observed that in pathological carpal tunnel SSCT, friction occurred in tendon movements, especially in connection with the increase in structure and size of type 3 collagen fibers [17,18]. In another study, an in vivo rabbit model was developed; in this model, SSCT was shown to cause CTS through the shear forces [19]. A study conducted at a molecular level reported that transforming growth factor (TGF-β) and connective tissue growth factors and receptors were found to be at higher levels in the SSCT tissue in the rabbit model and in patients with CTS [20]. This combination of the cycle that emerges upon overexpression of cytokines and the response given upon injury and fibrosis may explain why SSCT has increased elastin and collagen fiber size in patients with CTS compared to healthy population [21].

It has also been found that the hydrostatic permeability of SSCT is relatively low, suggesting that any leaking fluid (blood or lymph fluid from damaged vessels) can be rapidly absorbed by the SSCT and may contribute to increased intracarpal pressure [22,23].

Although these studies with synovial connective tissue provide a possible explanation for the pathophysiology of idiopathic CTS, it does not explain why not all individuals that perform repetitive hand activities develop symptomatic carpal tunnel syndrome. Moreover, some studies report that there was no

correlation between subsynovial connective tissue thickness and symptom duration, electrodiagnostic changes, age, and sex [24].

In the light of these studies, to achieve better clinical results in our clinic, we aimed to increase decompression by excising the SSCT in some of the patients undergoing surgical intervention for CTS. In two groups, we observed effect of the tenosynovectomy in our operated patients. However, the clinical results of the two groups with and without SSCT excision showed no statistically significant differences.

CONCLUSION

Although our primary goal in patients with SSCT excision was to relieve the median nerve by increasing decompression, we observed no intergroup differences in this large-scale study. It is our understanding that only intraoperative release of the transverse carpal ligament will be a satisfactory outcome.

A limitation of this study is that, this is a retrospective study. According to our opinion, in the future, more precise and objective study can be conducted of the same topic, on patients operated with the diagnosis of bilateral CTS, operating one side with syn+, the other side with syn-.

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Conflict of Interest: No conflict.
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Informed Consent: Written informed consent was obtained from all patients.

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