

## A descriptive study of 972 consecutive cases of carpal tunnel release: role of ancillary procedures

Karpal tünel serbestleştirilmesi yapılan ardı ardına 972 olgunun değerlendirilmesi:  
Ek olarak uygulanan girişimlerin rolü

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### Özet

**Amaç:** Karpal tünel serbestleştirilmesi, el cerrahisinin en sık uygulanan ameliyatlarından biridir. Karpal tünel serbestleştirilmesi, transvers karpal ligamanın açılarak median sinir üzerindeki basıyı kaldırma işlemidir. Bazı olgularda nöroliz, kitle çıkarılması veya sinovektomi gibi ek girişimlere ihtiyaç olabilir. Bu çalışmanın amacı açık karpal tünel serbestleştirilmesi yapılan bir dizi hastada ek olarak yapılan cerrahi girişimlerin dağılım ve sıklığını analiz etmektir.

**Yöntem:** Bu çalışmaya 2000 – 2011 yılları arasında, karpal tünel ameliyatı yapılan 694 hastanın 972 eli dahil edilerek standart serbestleştirmeye ilave olarak yapılan cerrahi prosedürlerin sıklığı tarandı.

**Bulgular:** Toplam 972 elin 56'sında (%5.76) transvers karpal ligamanın serbestleştirilmesine ilave cerrahi girişimler uygulandı. 9 olguda (%0.92) ganglia eksiyonu, 8 olguda (%0.82) sinovektomi, 13 olguda (%1.33) internal nöroliz, 23 olguda (%2.36) eksternal nöroliz, 3 olguda (%0.3) ise segmental nörektomi ve sinir onarımı yapıldı.

**Sonuç:** Standart serbestleştirmeye ek olarak yapılan cerrahi girişimlerin amacı endikasyonu olan olgularda nüks ihtimalini azaltarak cerrahi tedavi başarısını arttırmaktır.

**Anahtar sözcükler:** Karpal tünel cerrahisi, ek cerrahi girişimler.

### Abstract

**Objectives:** Carpal tunnel release is one of the most commonly performed operations in hand surgery. Carpal tunnel release is simply defined as division of transverse carpal ligament. Ancillary procedures such as neurolysis, mass removal, and synovectomy may be indicated in selected cases. The purpose of this study is to analyse the range and frequency of ancillary procedures in a series of open carpal tunnel releases.

**Methods:** In this study, an analysis of 972 consecutive open carpal tunnel releases was performed in 694 patients to assess the frequency of required additional procedures. Operation notes of these patients were reviewed in terms of ancillary procedures to standart carpal tunnel release.

**Results:** Fifty-six of 972 (5.76%) cases required an ancillary surgical intervention. Ganglia removal for 9 (0.92%), synovectomy for 8 (0.82%), internal neurolysis for 13 (1.33%), external neurolysis for 23 (2.36%), segmental neurectomy and nerve repair for 3 (0.3%) patients were performed.

**Conclusion:** Additional procedures is advocated as adjuncts to the carpal ligament release, in an effort to decrease the failure rate after operation in indicated cases.

**Key words:** Carpal tunnel surgery, ancillary procedures.

Carpal tunnel syndrome (CTS) is the most commonly seen compression neuropathy in clinical practice. For the diagnosis of CTS, clinical history, physical examination including sensibility, provocative and motor testing and electrodiagnostic studies such as electromyography (EMG) and nerve conduction studies (NCS) are used. However, some other pathologies such as solid masses, osseous pathologies

like previous radius fractures or volarly displaced lunatum dislocations, amyloidosis as a result of chronic renal failure and dialysis therapy, rheumatological and infectious disease induced synovitis may cause the symptoms of CTS narrowing carpal tunnel and compressing median nerve.<sup>[1-4]</sup> In such cases, additional surgical procedures such as mass removal, synovectomy or other surgical procedures to the malposed

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**Table 1.** Ancillary procedures in the series of surgical management in carpal tunnel syndrome

	Ancillary procedures	Number of patients	(%)
Surgery for space occupying lesions in carpal tunnel	Ganglia removal	9 (0.92%)	17 (1.7%)
	Synovectomy	8 (0.82%)	
Neural surgery	External neurolysis	23 (2.36%)	39 (4%)
	Internal neurolysis	13 (1.33%)	
	Segmental neurectomy + nerve repair (primary repair, nerve grafting)	3 (0.33%)	

bony structures may be indicated. Also in cases with long-standing nerve compression, additional surgical interventions to the neural tissue may be needed.

The purpose of this study is to analyse the range and frequency of ancillary procedures in a series composed of 972 open carpal tunnel releases.

## Materials and Methods

Between the years 2000 and 2011, 972 hands of 694 patients were consecutively operated for carpal tunnel release. Carpal tunnel was diagnosed with physical examination and electrodiagnostic studies. 572 of the patients were female, while 122 were male. Mean age of the patients was 40.63 (range: 25-72). A retrospective review of standardized patient charts and operation notes were performed to evaluate ancillary procedures in the series.

Conventional open technique carpal tunnel surgery under axillary regional block anesthesia and tourniquet application was performed to all patients. The incision starting from the midpalm and ending at a point 1 cm proximal to distal volar crease was preferred. Local anesthesia without tourniquet application was preferred for 15 dialysis cases with fistula at the same extremity. Throughout surgery, pathological findings such as ganglia formations and synovitis, and pathological nerve findings requiring epineurectomy, neurolysis, resection of damaged nerve segment and repair with primary neuroraphy or nerve grafting were noted and documented in detail. Pathological and microbiological specimens were taken when necessary.

Operation notes of 694 patients were reviewed in terms of ancillary procedures to standard carpal tunnel release. All surgical interventions required either for space occupying lesions in carpal tunnel or for the developing pathology of neural tissue were listed.

## Results

Ancillary procedures in this series of surgical management in carpal tunnel syndrome were listed in **Table 1**.

Volar ganglia located in the carpal tunnel was observed and resected following carpal tunnel release in 9 hands (0.92%) (**Fig. 1**). Widespread synovitis was observed and synovectomy was added to surgical procedure in 4 hands of the dialysis patients. Excessive synovial proliferation was observed in 4 non-dialysis patients. Three of these 4 were diagnosed as tuberculosis (**Fig. 2**). Carpal tunnel syndrome symptoms of these patients responded well to anti-tuberculosis medication, and disappeared completely without any need for further surgical treatment. Pathological assessment of one patient revealed non-specific synovial hypertrophy. The patient's symptoms were regressed following carpal tunnel release and synovectomy.

Neuroma formation was observed in 13 hands (1.33%) and either external neurolysis, limited epineurotomy or epineurectomy under surgical microscope was included to the procedure (**Fig. 3**). Two of the patients with neuroma formation were secondary cases, previously operated at other hand centers.

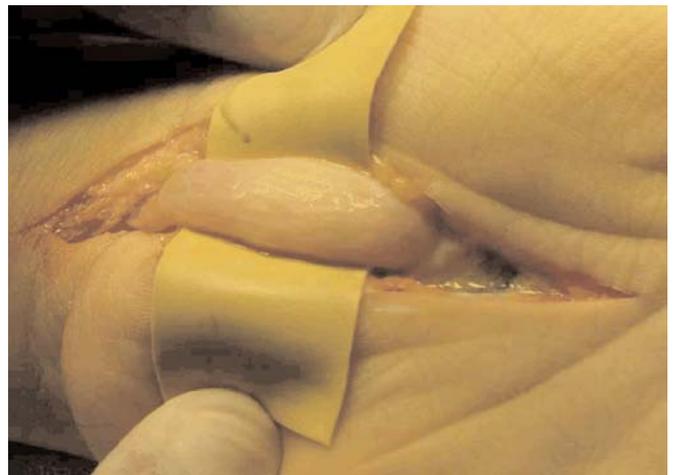
Two of 3 hands with near total anesthesia (pre-surgery two-point discrimination >15 mm) were treated with resection of the damaged segment and primary neuroraphy (**Fig.**



**Fig. 1.** Volar ganglia located in the carpal tunnel. [Color figure can be viewed in the online issue, which is available at [www.elmikrocerrahi.org](http://www.elmikrocerrahi.org)]



**Fig. 2.** Synovectomy and carpal tunnel release in a patient with tuberculosis. [Color figure can be viewed in the online issue, which is available at [www.elmikrocerrahi.org](http://www.elmikrocerrahi.org)]



**Fig. 3.** Neuroma formation was managed by external neurolysis. [Color figure can be viewed in the online issue, which is available at [www.elmikrocerrahi.org](http://www.elmikrocerrahi.org)]

4), while the other hand was treated with resection and sural nerve grafting (3 fascicles of 2 cm length) (**Fig. 5**). 23 hands (2.36%) with carpal tunnel syndrome were treated with additional external neurolysis due to presence of marked scarring or neural adhesions.

Eventually, 56 of 972 cases (5.76%) required additional surgical procedures to open carpal tunnel release.

## Discussion

Carpal tunnel syndrome is by far the most common compression neuropathy of the upper extremity. While etiology of most of the cases remains idiopathic without any specific pathology, previous radius fractures and volarly displaced lunate dislocations, space occupying masses, pregnancy,

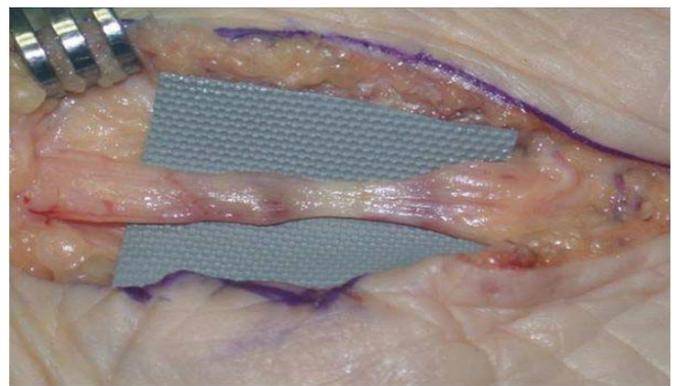
metabolic and systemic diseases (hypothyroidism, diabetes mellitus, amyloidosis), synovitis induced by rheumatological or infectious diseases may cause narrowing of the tunnel, resulting an increased pressure over the median nerve.<sup>[1-4]</sup>

Carpal tunnel syndrome is mostly diagnosed with examination of the symptoms, physical findings and electrodiagnostic tests. Routine application of radiodiagnostic tests, such as ultrasonography or magnetic resonance imaging, have never gained acceptance due to the cost-efficiency issues.

Surgical treatment of CTS is performed with either an open or endoscopic approach.<sup>[5-8]</sup> There is also a short-incision carpal tunnel release method, preferred by some authors.<sup>[9-11]</sup> Yet, independent from the method of release, division of the transverse carpal ligament may not address



**Fig. 4.** Sandglass deformity on median nerve, treated with segmental nerve. Excision and primary neuroraphy. [Color figure can be viewed in the online issue, which is available at [www.elmikrocerrahi.org](http://www.elmikrocerrahi.org)]



**Fig. 5.** Segmental median nerve damage in the carpal tunnel, managed by resection and sural nerve grafting. [Color figure can be viewed in the online issue, which is available at [www.elmikrocerrahi.org](http://www.elmikrocerrahi.org)]

the underlying causes resulting in symptoms of CTS. Additional procedures regarding any for space occupying lesions, nerves or tendons may be needed. There are still controversies on the role of these ancillary procedures for carpal tunnel release.<sup>[12]</sup> This study provides additional data regarding ancillary procedures with a relatively large number of case series.

Proper treatment of CTS caused by osseous or space occupying mass pathologies may only be accomplished by surgically eliminating the underlying cause. There is limited information on the frequency of solid masses in the etiology of CTS. Kang et al. found space occupying lesions in the carpal tunnel at 12 of 568 cases.<sup>[4]</sup> Stütz et al. reported 4 cases with tumors (2 ganglia, 1 fibroma and 1 lipoma) located in the carpal tunnel in their series of 200 patients, all of which previously went under surgery for CTS and readmitted with persistent symptoms.<sup>[13]</sup> Symptoms in these patients responded well to secondary surgery and tumor resection. In our series, 9 cases with ganglia and 8 cases with synovitis requiring synovectomy were encountered (1.7%). All masses were assessed as ganglia and were resected, following carpal tunnel release. In the follow-up, none of the patients showed any sign of recurrence or persistent symptoms. Widespread synovitis was found to be associated with amyloidosis in 4 cases, tuberculosis in 3 cases, and diagnosed as nonspecific proliferation in one case. No visible or palpable masses were noted with physical examination at the patients with volar ganglia.

Procedures on the median nerve such as external neurolysis, epineurotomy, epineurectomy, or internal neurolysis in the treatment of CTS is controversial and indications for such ancillary procedures are not brief in the literature. Previous carpal tunnel surgery may cause scarring around the median nerve, even resulting in adhesion of the nerve to the radial border of the tunnel, causing the relapse of the symptoms. External neurolysis is an essential step of the secondary surgical procedure in this selected group of patients, in our opinion. Rhoades et al. indicated that internal neurolysis have especially been beneficial in elderly patients.<sup>[14]</sup> On the other hand, experimental studies demonstrated scarring formation around the nerve fascicles following internal neurolysis.<sup>[15]</sup> McKinnon et al. and Chapell et al. presented that interventions on the nerve do not have a positive influence and may produce unfavorable results.<sup>[16,17]</sup> Most remarkable note in these studies is the fact that performing epineurotomy or neurolysis is decided before surgery, regarding thenar atrophy, increased motor and sensory latency in EMG tests, or increased two-point discrimination. In our opinion, associated segment of the nerve must definitely be visually inspected in suspicious cases. In cases where compression is significant at some point, proximally located bulbous shaped

neuroma formation may occur, followed by a weakened and thinned nerve segment. Gentle palpation of the nerve with two fingers may reveal a more solid and bulged sense of touch over the neuroma formation, and excessively soft distally. In our series, after the cases with neuroma-in-continuity were evaluated under surgical microscope, epineurium was either incised or partially excised in longitudinal fashion, and segment interfering axonal transition was released. Neurolysis is not regarded as a routine component of carpal tunnel release procedure in our department. Yet, neurolysis may be necessary in severe cases with long lasting symptoms and previously operated cases without the relief of symptoms. Internal neurolysis shall only be decided after meticulous inspection of the median nerve under operation microscope. We suggest that release of synovial and epineurial adhesions around the nerve have a positive influence on the results in selected cases. In cases with motor deficit, the segment where recurrent branch is divided from the median nerve must be inspected and surgical release must be provided if necessary.

In three cases (0.3%) of our series, preoperative evaluation revealed severely diminished protective sensation (two-point discrimination >15 mm) and near total anesthesia over the median nerve dermatome. Significant atrophy of thenar eminence and sharply positive Tinel sign were noted in all of these patients. Two of the cases were repaired with primary neuroraphy, while the other patient was treated with 3 slips of sural nerve grafting to fulfill a 2 cm gap. Segmental nerve resection and nerve repair is definitely not a treatment modality for carpal tunnel syndrome. However, when preoperative examination and electrodiagnostic tests reveal intrinsic motor and sensational loss and intraoperative findings reveal a severely injured median nerve (Sunderland Grade IV) with low expectancy of spontaneous recovery, nerve resection and either primary repair or nerve grafting should be considered.

In this paper, a relatively large number of 972 cases of CTS treated with open carpal tunnel release were evaluated retrospectively. 56 of 972 cases (5.76%) required additional surgical procedure to carpal tunnel release, with respect to the widely accepted indications in the literature. In a selected group of patients, USG and/or MRI shall be included to the preoperative diagnostic tests. In our experience, preoperative MRI or USG tests shall be benefited in unilateral or recurrent cases, elder or dialysis dependant patients. Carpal tunnel release is a straightforward and easy procedure. However, hand surgeons should keep in mind that additional surgical interventions may be necessary and have the ancillary procedures in their armamentarium.

**Conflicts of Interest:** No conflicts declared.

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