

Evaluation of Functional Outcome after Surgery for Cubital Tunnel Syndrome

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Abstract

Objectives: Surgical outcome of the patients undergoing decompression and minimal medial epicondylectomy were retrospectively evaluated.

Methods: 16 patients who underwent decompression and minimal medial epicondylectomy for the treatment of cubital tunnel syndrome (CTS) were retrospectively evaluated. 11 female (68.75%) and 5 male (31.25%) patients suffering from unilateral CTS that is unresponsive to conservative treatment were included to the study. Average age was 39.18±14.36 years. Left side involvement occurred in 12 patients (75%), while right side involvement occurred in 4 patients (25%). McGowan classification of ulnar nerve injury was used for the surgical grading. Grade 1 in four patients (25%), grade 2 in 11 patients (68.75%), and grade 3 in 1 patient (6.25%). Cervical disc herniation, thoracic outlet syndrome and other entrapment neuropathies were ruled out preoperatively. Results of surgical treatment were evaluated according to Wilson–Kroot criteria. Patients were followed during 18 – 64 months in average. Findings: Symptomatic relief was achieved in all of the patients. Postoperative controls in the 1st, 6th and 12th months revealed excellent results for 12 patients (75%), good results for 3 patients (18.75%), and a medium result for 1 patient (6.25%). No patient experienced ulnar nerve paralysis, medial elbow instability and impairment in the pronator – flexor muscle group in the postoperative period. Pain and sensitivity in the osteotomy site of 3 patients (75%) who underwent minimal medial epicondylectomy disappeared three months later.

Results: Minimal medial epicondylectomy and decompression are reliable and effective methods for the treatment of cubital tunnel syndrome with less complication rates.

Keywords: Cubital tunnel syndrome; Medial epicondylectomy; Surgical treatment; Ulnar nerve

Introduction

Ulnar nerve entrapment that usually arises in the elbow region is the second most commonly seen entrapment neuropathy after carpal tunnel syndrome. Miscellaneous etiological factors have been assumed to be associated with this disorder called cubital tunnel syndrome and many treatment methods have been defined. Various etiological factors resulting in the nerve compression associated with the anatomic position of ulnar nerve were presented. Facial band compressions, ulnar nerve subluxation, cubitus valgus, bone bumps, tumors, ganglions and heterotypic ossifications were the most frequently suspected entities when literature was reviewed [1,2]. In our study, we retrospectively reviewed the postoperative outcome of the patients with cubital tunnel syndrome.

Materials and Methods

Decompression were applied to 12 patients and minimal medial epicondylectomy were applied to 4 patients (11 women, 5 men, average age distribution was 18 – 77) with cubital tunnel syndrome non responsive to conservative treatment between the years 2009 and 2011 (Table 1). Patients were examined with their preoperative history, physical examination and electrodiagnostic tests. The most common preoperative complaints were pain (12 patients = 75%), motor weakness (10 patients = 62.5%) and paresthesia (8 patients = 50%). All patients were presented with hypothenar atrophy and motor loss with various severities. Sensorial disturbances were determined to be 37.5% (6 patients). Retardation in the denervation potentials, motor and/or sensitive nerve transmissions were determined by electrophysiological tests.

Unilateral ulnar nerve involvement ratio was 75% (12 patients) on the left side and 25% (4 patients) on the right side. No underlying reason could not be determined in the majority of patients (14 patients) while the rest of the patients (2 patients) were presented with right

ulnar nerve schwannoma and traumatic disorder. Entrapment of the ulnar nerve only in the elbow region was included to the study. Cubital tunnel syndrome patients who have also the diagnosis of cervical disc herniation, thoracic outlet syndrome and congenital pathologies were excluded. The beginning time interval of the complaints until the operation was 8 – 24 months. Patients were presented with pain in the distal sites of the forearm, carpal and ulnar sites of the hand and sensory loss in the fourth and fifth fingers. Physical examination revealed hypoesthesia on the ulnar site of the fourth and fifth fingers and a positive Tinnel sign on the elbow. The sensory loss on the fourth and fifth fingers was observed to increase when the arm was kept in the full flexion approximately for 30 seconds. About half of the patients presented with several levels of impairment or muscle atrophy in the affected region. No hand pouncing sign patterns were detected in the patients. Bilateral (AP and lateral) elbow radiographs were employed to determine any bone pathology resulting in ulnar nerve compression. No osteophyte (bone spurs) formation or abnormal valgus movement angle were seen. All patients underwent electrodiagnostic tests and electroneuromyography. Entrapment grading was evaluated according to McGowan system preoperatively (Table 2) 15). 4 patients (25%) with normal electrodiagnostic results were classified as grade 1. 11 patients (68.75%)

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Age-Sex	Complaint presented	Neurological Exam	EMG	Surgical Methods	Results, Wilson-Krout Criteria	Follow up period
49, male	Pain and weakness in the left hand	Motor weakness in the 4th and 5th fingers of left hand	Left ulnar nerve lesion	Decompression, Minimal medial epicondylectomy	Pain relief, Neurological examination normal, Excellent	18-36 months
52, female	Pain in right arm and hand	Hypoesthesia in the 4th and 5th fingers of right hand	Right ulnar nerve partial lesion	Decompression	Pain relief, Neurological examination normal, Excellent	18-36 months
39, female	Numbness in the 4th and 5th fingers of left hand	Hypoesthesia in the 4th and 5th fingers of left hand	Left ulnar neuropathy	Decompression	Pain relief, Neurological examination normal, Excellent	18-36 months
29, female	Pain and numbness in the 4th and 5th fingers of left hand	Motor weakness in the 4th and 5th fingers of left hand	Left ulnar nerve lesion	Decompression	Pain relief, Neurological examination normal, Good	18-36 months
33, female	Pain and numbness in the 4th and 5th fingers of left hand	Motor weakness in the 4th and 5th fingers of left hand	Left ulnar neuropathy	Decompression, Minimal medial epicondylectomy	Pain relief, Neurological examination normal, Excellent	18-36 months
49, male	Pain and numbness in the 4th and 5th fingers of left hand	Motor weakness in the 4th and 5th fingers of left hand	Left ulnar nerve lesion	Decompression	Pain relief, Neurological examination normal, Excellent	18-36 months
37, male	Pain and numbness in right forearm and hand	Motor weakness in the 4th and 5th fingers of right hand	Right ulnar nerve lesion	Decompression	Pain relief, Neurological examination normal, Excellent	18-36 months
41, female	Pain and numbness in the 4th and 5th fingers of right hand	Hypoesthesia in the 4th and 5th fingers of right hand	Right ulnar nerve lesion	Decompression	Pain relief, Neurological examination normal, Excellent	18-36 months
26, male	Pain and numbness in the left elbow and hand	Motor weakness in the 4th and 5th fingers of right hand	Left ulnar neuropathy	Decompression	Pain relief, Neurological examination normal, Excellent	18-36 months
77, female	Pain and numbness in the right forearm and hand	Motor weakness in the 4th and 5th fingers of right hand	Right ulnar nerve lesion (ulnar schwannoma)	Decompression, Minimal medial epicondylectomy	Pain relief, Neurological examination normal, Good	18-36 months
22, female	Pain and numbness in the 4th and 5th fingers of left hand	Hypoesthesia in the 4th and 5th fingers of left hand	Left ulnar neuropathy	Decompression	Pain relief, Neurological examination normal, Excellent	18-36 months
36, female	Pain and numbness in the 4th and 5th fingers of left hand	Motor weakness in the 4th and 5th fingers of left hand	Left ulnar neuropathy	Decompression	Pain relief, Neurological examination normal, Good	18-36 months
49, male	Pain and numbness in the left elbow and hand	Motor weakness in the 4th and 5th fingers of left hand	Left ulnar neuropathy	Decompression Minimal medial epicondylectomy	Pain relief, Neurological examination normal, Excellent	18-36 months
42, female	Pain and numbness in the 4th and 5th fingers of left hand	Hypoesthesia in the 4th and 5th fingers of left hand	Left ulnar neuropathy	Decompression	Pain relief, Neurological examination normal, Medium	18-36 months

18, female	Pain and numbness in the 4th and 5th fingers of left hand	Motor weakness in the 4th and 5th fingers of left hand	Left ulnar neuropathy	Decompression	Pain relief, Neurological examination normal, Excellent	18-36 months
28, female	Pain and numbness in the left elbow and hand	Hypoesthesia in the 4th and 5th fingers of left hand	Left ulnar neuropathy	Decompression	Pain relief, Neurological examination normal, Excellent	18-36 months

Table 1: Patients Operated with the Diagnosis of Cubital Tunnel Syndrome.

Grade	Description
1t	Purely subjective symptoms and mild hypoesthesia
2	Sensory loss and weakness of intrinsic hand muscles and/or slight wasting
3	Severe sensorimotor deficit

Table 2: McGowan Classification of Ulnar Nerve Injury.

showing muscular impairment and abnormal electrodiagnostic results were graded as grade 2. Grade 3 nerve compression was observed in 1 patient (6.25%) with prominent muscular atrophy and advanced sensitivity loss. Several protective methods including activity modification, use of splints at nights, NSAIDs (non-steroidal anti-inflammatory drugs) and corticosteroids were administered preoperatively to all the patients for at least six month (distribution ratio: 6 – 12 months) However no recovery was observed.

Surgical Technique

1 patient was operated with axillary block while the rest of the patients were operated under general anesthesia. Following the proper position, a medial incision extending from 5 – 8 cm proximal to 5 – 8 cm distal of medial epicondyle was applied. Cutaneous and subcutaneous tissues were operated considering the medial antebrachial cutaneous nerves (of arm). Ulnar nerve dissection was pushed towards the proximal and distal direction and thereby enabling the detachment of nerve. While relaxing cubital tunnel and flexor carpi ulnaris aponeurosis, all the branches of ulnar and medial antebrachial cutaneous nerves were protected. It was paid attention not to damage the blood circulation of ulnar nerve. Later, an incision was performed in the site where the flexor – pronator muscle connected to the medial epicondyle and thereby applying a subperiosteal dissection. Following this procedure, medial epicondylectomy was initiated. The medial collateral ligament was protected in the medial epicondyle with osteotomy (0.8 mm) and the bone resection was performed thereby enabling the slide of ulnar nerve in the direction of anterior and posterior line on the epicondyle. All the margins in the osteotomized region were ablated and then the dissected periost was sutured. The final control was done in order to ensure that the nerve slide on a flat surface and particularly not to be compressed by the medial epicondyle in the elbow flexion. Just after the operation, arm movements were not restricted. Sutures were removed ten days after the operation. Patients were called for follow the complications and elbow range of motion up on the first month postoperatively. Later, the follow-up's were performed in the 3rd, 6th, and 12th months and then per year. Surgical results were evaluated as excellent, good, medium and poor according to the Wilson–Krout criteria [3]. Patients were observed between 18 – 36 months in average.

Results

All patients showed symptomatic relief after the operation. The results of 12 patients (75%) were evaluated as excellent, 3 patients (18.75) as good and 1 patient (6.25%) as medium. The excellent and good results were acquired from the patients presenting with low preoperative

involvement rates (McGowan criteria grade 1 and 2). 1 patient with advanced nerve compression level (grade 3) was evaluated with medium result. Development in the motor and sensorial functions was evaluated with objective tests. It was revealed that the sex, involved extremity, the preoperative duration of the symptoms and abnormal electrodiagnostic test results were of substantial significance for McGowan system parameters. Postoperative ROM (range of motion) was full in the both elbows. No ulnar nerve paralysis, subluxation and/or medial elbow instability were observed. Any impairment was not experienced in the pronator – flexor involvement site. Slight pain and sensitivity in the surgical site of three patients spontaneously disappeared within three months (distribution 1 – 6 months). No superficial or deep wound infection originated around the skin incision.

Discussion

Ulnar nerve compression is the second most common compression neuropathy in the upper extremity. Vast majority of reported cases were idiopathic. The most frequent underlying reason was the pressure and compression effect of anatomic structures on the ulnar nerve [1,2,4]. This disorder primarily arises from bone abnormalities (osteophytes, cubitis valgus), soft tissue masses (ganglion tumor), compression associated with facial structures and subluxation of the medial epicondyle upon the ulnar nerve [2,4,5]. C8 and T1 nerve roots give rise to the medial cord which in turn, forms the ulnar nerve. In the middle one third of the arm, the ulnar nerve accompanies the superior ulnar collateral artery posteriorly through the intermuscular septum to lie on the anterior aspect of the medial head of the triceps muscle. The nerve travels on the posterior surface of the intermuscular septum medial to the humerus, to reach the elbow. It traverses the elbow region bounded medially and anteriorly (superiorly) by the medial humeral epicondyle, laterally by the olecranon and by a connective tissue roof spanning the two bony prominences-the “epicondylar groove.” The nerve then enters the “cubital tunnel” by passing deep to the arcuate ligament (Osborne’s ligament), which connects the ulnar and humeral heads of the flexor carpi ulnaris (FCU) muscle. The nerve then passes between the two heads of the FCU and passes deep to the deep flexor pronator aponeurosis. It then travels through the forearm between the FCU and flexor digitorum profundus (FDP), giving off motor branches to the FDP of the small and ring fingers. The nerve enters the wrist through Guyon’s canal; a fibro-osseous canal, extending 4 cm from the palmar carpal ligament to the fibrous edge of the hypothenar muscles. This is also a common site of ulnar nerve entrapment [5-7]. Entrapment in the cubital tunnel at or just distal to the elbow produces the cubital tunnel syndrome. Cubital tunnel syndrome is characterized by discomfort (pain,

numbness and/or tingling) in little finger and ulnar half of ring finger, elbow pain and hand weakness. Cramping and easy fatiguing of the ulnar innervated muscles of the hand may occur. Symptoms increase with elbow flexion but reduce with extension. This application is accepted as a diagnostic test for cubital tunnel syndrome [1,2]. Buehler and Thayer reported that elbow flexion test is 91% sensitive and 97% specific for CTS. Electromyography (EMG) is considered as the most valuable diagnostic tool for CTS [7]. However, there are also some publications reporting that EMG can give false positive results in 15% of the patients and is not required for the diagnosis of CTS if the clinical signs are clear. In the treatment of CTS, many procedures including non-surgical and surgical interventions are applied. Non-surgical treatment is first choice. Conservative approaches include activity modification, night splints, NSAIDs and corticosteroids. Surgical procedure is reserved for those with disability and weakness [8]. Surgical options consist of simple nerve decompression, medial epicondylectomy, subcutaneous anterior transposition and submuscular anterior transposition. McGowan classified the cases with CTS according to the severity of symptoms [9]. However partially subjective, this classification system determines the severity of nerve damage by evaluating the pain, sensorial disturbances, deformities and functions. This system also enables a good estimation of possible recurrence. McGowan system showed that surgical treatment was indicated for grade 1 and over chronic neuropathies [1,9]. Most frequently adopted surgical treatment procedures include the simple decompression with or without anterior transposition of ulnar nerve and medial humeral epicondylectomy. Ulnar nerve may be decompressed by cutting off the arcuate ligament which is an aponeurotic fibrotic band and covers the cubital tunnel (simple decompression) [10]. Simple decompression includes several advantages such as decompression within a small incision, limited surgical dissection, and preserved blood supply of ulnar nerve [2,4,8]. This method may be employed when slight neuropathy exists with painless, normal bone anatomy [2,4]. In situ decompression was compared with anterior transposition in various studies and it was determined that the results were less satisfactory [11-13]. The subcutaneous, intramuscular or submuscular transposition of ulnar nerve in the antecubital fossa is still frequently preferred in spite of having some substantial disadvantages. The major disadvantages include the radical decrease in the extrinsic blood supply of the nerve as a result of anterior transposition and frequent destruction of small, perforating nerve branches during surgery. The ulnar nerve is fed in the cubital tunnel by the upper and lower collateral vessels originating from posterior recurrent ulnar artery. These vessels are eradicated during anterior transposition and the nerve relatively becomes hypovascular [7,14]. This relative ischemia is considered to be responsible for resulting in the corruption of nerve functions and also for the complications occurred [15]. Ogata and Naito reported that intraneural blood circulation was radically decreased following the nerve dissection [16]. In most of the studies, classic medial epicondylectomy was reported to be an effective method in the treatment of cubital tunnel syndrome [2,5,8]. In these studies, symptomatic relief was reported to be over 90% and excellent and good result was between 56% and 74%, respectively [2,5,17]. Major advantages of the medial epicondylectomy in the literature include the elimination of underlying reasons of compression (medial epicondyle, arcuate ligament, two ends of flexor carpi ulnaris), less traumatization of ulnar nerve, protection of blood circulation and small proximal nerve branches, preservation of the nerve motion in its own line and the early initiation of arm movements postoperatively. However, this technique also includes some disadvantages such as the development of medial elbow instability, sensorial disturbances in the osteotomy site, the impairment of flexor – pronator

muscle strength and disappearing of bone protective after excision of protective spurs originating from medial epicondyle leads the ulnar nerve tend to trauma [17,18]. Even after the slight traumas, symptoms may be recurrent [18,19]. It was concluded that excision of 20% of the medial epicondyle on the coronal base would be sufficient for decompression without damaging anterior medial and collateral ligament [18-20]. Furthermore, Heithoff et al reported that they had established a staging system for the patients undergoing medial epicondylectomy on the basis of postoperative radiographic examinations and classified all the patients as complete, partial and minimal osteotomy [19,21,22]. They also concluded that the patients undergoing complete osteotomy showed excellent and good results in great rates (81%) but the satisfaction rates substantially decreased (50%) and all the patients presented with valgus instability in the rate of 43%. In the recent studies, it has been observed that the results of minimal epicondylectomy are similar to those of complete epicondylectomy and elbow instability has developed relatively less [18]. Persistent pain and hypersensitivity in the operation site were commonly experienced after medial epicondylectomy [2,4]. Heithoff et al measured the strength of forearm flexor muscles after medial epicondylectomy and found a decrease of 5% and 10% in the pinch and grip strengths, respectively [18,21]. However, it is accepted that these loss rates are mean values representing slight strength loss and they are very hard to be defined with clinical methods. In our study, 12 of 16 patients (75%) underwent simple decompression while the rest of the patients (25%) underwent decompression and medial epicondylectomy. No substantial differences were found in terms of treatment efficiency during the clinical follow up. Simple decompression and minimal medial epicondylectomy is an effective approach in the treatment of cubital tunnel syndrome. This modified approach was developed in order to reduce the possible disadvantages of classical medial epicondylectomy. Minimal medial epicondylectomy was applied to 64 patients (66 elbows) and 79% excellent – good results were acquired [12]. It was also concluded that this method was relatively effective in the treatment of cubital tunnel syndrome with low complication rate. Medial elbow pain was found the major complication in the 30% of the patients even one year after the operation. Excellent – good results were achieved in the 75% of the 54 patients (60 elbows) undergoing partial medial epicondylectomy for the treatment of cubital tunnel syndrome, and they also obtained one stage better recovery at least in 88.3% of the cases when compared with McGowan criteria [18,19,23]. Partial medial epicondylectomy was reported to be a satisfactory surgical approach in the treatment of McGowan stage I and II lesions, and it was found out that there was an inverse relationship between the primary neurological involvement and complete recovery process. All of the 16 patients in our study showed clinical recovery. Compatible with the literature results, patients with low compression levels showed better results. The major postoperative complaints were pain and sensitivity in the osteotomy region, but the complications such as paralysis or medial elbow instability were not seen.

Conclusion

This study shows that minimal medial epicondylectomy and ulnar nerve decompression is a reliable and effective approach in the treatment of cubital tunnel syndrome. Excellent – good results were obtained in most of the patients. Complications of pain and hypersensitivity limited to the osteotomy region fully disappeared a few months after the operation.

Minimal medial epicondylectomy is a method which enables the decompression method and the slide of ulnar nerve towards the frontier side of epicondyle without any risk of instability or devascularization. The accurate and correct application and convenient follow up of

this technique in the postoperative period may substantially prevent the possible complications.

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