Original article

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IS ULNAR NERVE DECOMPRESSION AND ANTERIOR TRANSPOSITION EFFECTIVE ON ELBOW RANGE OF MOTION IN THE TREATMENT OF CUBITAL TUNNEL SYNDROME?

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The aim of this study was to evaluate the clinical results and elbow range of motion in patients with cubital tunnel syndrome who underwent decompression and anterior ulnar nerve transposition.

There were 11 patients, 7 male and 4 female. Mean age of the patients was 45.45 ± 16.22 years. The mean follow-up period of the patients was 14.81 ± 6.98 months. Decompression and anterior transposition of the ulnar nerve were performed in all patients. Patients were classified according to McGowan-Goldberg classification system before surgery and in the last control after surgery. VAS scores, flexion and extension range of motion were evaluated before surgery and in the last control after surgery.

Eight patients had stage 2A according to McGowan-Goldberg classification system and 3 patients had stage 2B preoperatively. Postoperatively, 10 patients were stage 0 and one patient was stage 1. Preoperative mean VAS score was 8.45 ± 0.93 and postoperative mean VAS score was 1.45 ± 2.29. Preoperative mean elbow flexion-extension range of motion was 118.64° ± 11.42° and postoperative mean elbow flexion-extension range of motion was 128.63° ± 7.77°. We found statistically significant difference between preoperative and postoperative VAS values and elbow flexion extension range of motion.

Anterior subcutaneous ulnar nerve transposition is an effective surgical treatment method with increasing elbow range of motion in patients with cubital tunnel syndrome.

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Key words: *cubital tunel, ulnar nerve, decompression*

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Introduction

Cubital tunnel syndrome is the second mostly seen compression neuropathy of the upper extremity after carpal tunnel syndrome (1). There are dynamic and static factors in the etiology. Static factors include osteoarthrosis of the elbow, cubitis valgus, ganglion cysts around the nerve, trauma and the masses causing compression. Increased pressure on the cubital tunnel with elbow flexion, recurrent minor micro-traumas and subluxation of the ulnar nerve constitute dynamic factors (2-4).

The ulnar nerve can be compressed at 5 anatomical points around the elbow. These are arcade of Struthers, the medial intermuscular septum, the epicondylar groove, the Osborne ligament, and flexor pronator aponeurosis. The most common compression is seen in the Osborne ligament and epicondylar groove (5).

The loss of sensation and numbness in the sensory area of the ulnar nerve, loss of grip strength and clawing of the fingers are symptom of cubital tunnel syndrome. Ulnar nerve dysfunction is divided into 3 phases by McGowan.

Stage 1: sensory changes,
Stage 2: reduction in muscle strength,
Stage 3: paralysis and muscle atrophy (6).

Surgical treatment procedures are applied if conservative treatment does not make any improvement in clinical signs and symptoms. Surgical approaches are divided into two groups as superficial and deep. In situ decompression and anterior subcutaneous transposition of the ulnar nerve are superficial approaches, medial epicondylectomy or anterior sub or intramuscular transposition are deep surgical approaches (7-9).

The aim

The aim of this study was to evaluate the clinical results and elbow range of motion in patients who underwent decompression and anterior ulnar nerve transposition without any response to conservative treatment.

Materials and methods

This retrospective study was approved by the Ethics Board of our institution (approval number 2019-17/01) and conducted in accordance with the Declaration of Helsinki. Informed written consent was obtained from all patients included in the study.

In this study, 11 patients who were diagnosed with cubital tunnel syndrome and confirmed with electromyography (EMG) were included in the study. There were 7 male and 4 female patients. Decompression and anterior transposition of the ulnar nerve were performed in all patients.

The inclusion criteria comprised patients between 18-75 years of age, who had no neurological disease and did not respond to 6-week conservative treatment. Patients with cervical pathologies were excluded from the study. Patients under 18 years of age and over 75 years of age and patients who had undergone surgical treatment for cubital tunnel syndrome were excluded from the study.

All patients had positive Tinel's sign and elbow flexion tests with complaints of cubital tunnel syndrome. The diagnosis of cubital tunnel syndrome was confirmed by EMG and nerve conduction velocity. All patients with cubital tunnel syndrome were included in a 6-week physical therapy program. Patients who did not benefit from physical therapy and rehabilitation program were treated surgically.

Patients were classified according to McGowan-Goldberg classification system before surgery and in the last control after surgery (6, 10). VAS scores, flexion and extension range of motion were evaluated before surgery and in the last control after surgery.

Surgical technique

All surgeries were performed under general anesthesia and no tourniquet was used. The patients underwent surgery in the supine position. Incision was about 7-8 cm and started approximately 2 cm proximal to the medial epicondyle to the medial side of the flexor carpi ulnaris parallel to the ulnar nerve trace. Release and decompression were performed for all soft tissues which left the ulnar nerve under pressure in the cubital tunnel. Release of the ulnar nerve was performed from the distal side to the proximal side (Figure 1). The ulnar nerve was transposed into the subcutaneous area and the subcutaneous tissue was sutured into the deep fascia to cover the ulnar nerve. A new channel was formed for the ulnar nerve. After surgery, the operated extremities were not immobilized and were immediately allowed to range of motion.

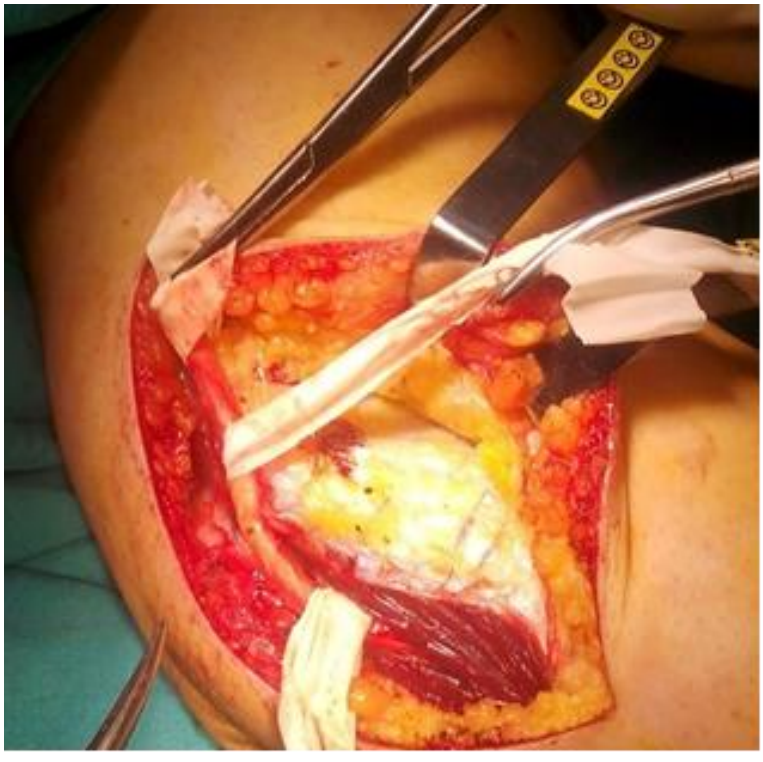

Figure 1. Release and decompression of the ulnar nerve from the distal side to the proximal side

Statistical analysis

The normal distribution of the data was tested and the Wilcoxon test was used as the non-parametric version of the matched test since they were not distributed normally. A value of $p < 0.05$ was considered statistically significant in the 95% confidence interval.

Results

Of 11 patients, in 8 patients surgery was performed on the right side and in 3 patients on the left side. When the etiologies of 11 patients were evaluated, it was found that all of the patients did not have cubital tunnel syndrome secondary to trauma and all were idiopathic. Mean age of the patients was 45.45 ± 16.22 years. The mean follow-up period of the patients was 14.81 ± 6.98 months. Out of 11 patients, 10 patients reported that they were satisfied after surgery. Eight patients had stage 2A according to McGowan-Goldberg classification system and 3 patients had stage 2B preoperatively. Postoperatively, 10 patients were stage 0 and one patient was stage 1 (Table 1). Preoperative mean VAS score was 8.45 ± 0.93 and mean postoperative VAS score was 1.45 ± 2.29. Preoperative mean elbow flexion extension range of motion was 118.64° ± 11.42° and postoperative mean elbow flexion extension range of motion was 128.63° ± 7.77° (Table 2). We found statistically significant difference between preoperative and postoperative VAS values and elbow flexion extension range of motion ($p \leq 0.05$). No infection was detected related to surgery during the follow up period. We did not see any wound problems like hematoma due to bleeding problems.

McGowan-Goldberg classification system	Stage 2A	Stage 2B	Stage 1	Stage 0
Preoperative	8	3	0	0
Postoperative	0	0	1	10

Table 1. Preoperative and postoperative distribution of the patients according to McGowan-Goldberg classification system

	Mean VAS score	Mean range of elbow motion
Preoperative	8.45 ± 0.93	118.64° ± 11.42°
Postoperative	1.45 ± 2.29	128.63° ± 7.77°

Table 2. Preoperative and postoperative VAS scores and elbow range of motion values

Discussion

The oval form of the cubital tunnel becomes elliptical with elbow flexion. A 55% reduction in cubital tunnel volume and increased pressure around the ulnar nerve was detected with elbow flexion (11-14). The elbow flexion leads to an elongation of 4-7 mm in ulnar nerve due to the distance of the ulnar nerve from the elbow center of rotation and increase compression on ulnar nerve during elbow flexion due to the effect of traction (15). Anterior transposition of the ulnar nerve decreases the tension on ulnar nerve with elbow flexion and elbow extension does not create additional tension on ulnar nerve in elbow extension (16). The main idea of ulnar nerve anterior transfer is to reduce the intrinsic pressure on the nerve during elbow flexion (17). Ulnar nerve tension has been found to increase by 29% during elbow flexion (18). Simple decompression has been shown not to reduce traction forces on the ulnar nerve during elbow flexion (19).

The results of the meta-analysis comparing the patients who underwent simple decompression and ulnar nerve transposition in patients with idiopathic cubital tunnel syndrome showed no difference between the clinical results and nerve conduction velocities of both groups. Simple decompression was proposed due to easier surgical technique and faster recovery period (20).

Seyfettinoglu et al. compared anterior transposition and simple decompression in relation to blood flow and functional results. They found no statistically significant difference between both groups

about functional results but no arterial blood flow of ulnar nerve was found in five of seven patients who underwent anterior transposition and 2 patients had blood flow decrease of 20 cm/s. Mean 10 cm/s blood flow decrease was detected in the simple decompression group. There was a significant difference between the two groups in relation to blood flow. As a result of the study, simple decompression may be considered as the first option (21).

Macadam et al. compared clinical outcomes of the patients in whom they performed anterior ulnar nerve transposition and simple decompression. Their results showed that patients who underwent anterior transposition had better clinical outcomes than patients who underwent simple decompression (22). Our clinical results showed the improvement in pain and range of motion but the lack of a comparison group restricts our study.

Keith and Wollstein decided to perform anterior transposition according to the stability of the ulnar nerve during surgery and found improvement in upper extremity functions in 90% of patients (23). Stability of the ulnar nerve can be an important criterion for transfer to the anterior but we did not control the stability of the ulnar nerve during surgery, however, we detected a statistically significant difference in terms of elbow range of motion before and after surgery.

Black et al. found that subcutaneous ulnar nerve transposition was easier surgical technique than submuscular transposition with less bleeding, and shorter surgical time (24). Subcutaneous transfer of the ulnar nerve causes less pain and allows early motion after surgery (25, 26). Allowing elbow motion in the early postoperative period allows the ulnar nerve to slide during movement and prevent the formation of perineural fibrosis (27). We detected increased elbow range of motion after surgery. We think that there are two main reason for improved range of motion: the first one is allowing elbow movements in the early postoperative period, the second one is making the ulnar nerve trace get closer to motion center of elbow joint by anterior transfer thereby reducing traction on the ulnar nerve.

Infection rates are less in patients who underwent subcutaneous ulnar nerve transfer. Bartels et al. showed that infection rates were higher in patients who underwent submuscular ulnar nerve transposition (28). We detected no infection during the follow up period. Our results are in accordance with the literature.

Conclusion

Anterior subcutaneous ulnar nerve transposition is an effective surgical treatment method with increasing elbow range of motion in patients with cubital tunnel syndrome.

Conflict of interest

None of the authors of this manuscript received funding, grants, or in-kind support in support of this research or the preparation of this manuscript. The authors have no financial relationships with any company. Each author certifies that he or she has no commercial associations (e.g., consultancies, stock ownership, equity interest, patent/ licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted article. We, the authors, declare that we have all participated in the design, data collection, statistical analysis, data interpretation, literature search and manuscript preparation of the paper, and that we have approved the final version.

Ethical Review Committee Statement

The study was approved by the Ethics Committee of Bahçeşehir University Medical School (number: 2019-17/01).

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DA LI DEKOMPRESIJA I ANTEARIORNA TRANSPOZICIJA ULNARNOG NERVA POZITIVNO UTIČU NA OPSEG POKRETA U LAKTU U LEČENJU SINDROMA KUBITALNOG TUNELA?

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Cilj ove studije bila je procena kliničkih rezultata i opsega pokreta lakta kod bolesnika sa sindromom kubitalnog tunela, kod kojih su urađeni dekompresija i transpozicija anteriornog ulnarnog nerva.

Ukupno je bilo 11 bolesnika, sedmoro muškaraca i četiri žene. Prosečna starost bolesnika iznosila je 45,45 godina ± 16,22 godine. Prosečno trajanje praćenja bolesnika bilo je 14,81 mesec ± 6,98 meseci.

Dekompresija i anteriorna transpozicija ulnarnog nerva urađeni su kod svih bolesnika. Bolesnici su bili klasifikovani prema McGowan-Goldberg klasifikaciji pre operacije, kao i na poslednjem kontrolnom pregledu, nakon operacije. VAS skor, opseg pokreta u fleksiji i eksteziji, takođe su procenjivani pre operacije, ali i na poslednjem kontrolnom pregledu nakon operacije.

Prema McGowan-Goldberg klasifikacionom sistemu, osmoro bolesnika je na skali ocenjeno sa 2A, dok je troje bolesnika ocenjeno sa 2B, pre hirurške intervencije. Postoperativno, desetoro bolesnika je na skali dobilo 0, dok je jedan bolesnik na skali dobio 1. Preoprativno, srednja vrednost VAS skora iznosila je 8,45 ± 0,93, dok je njegova vrednost u postoperativnom periodu bila 1,45 ± 2,29. Preoprativno, srednja vrednost opsega fleksije i ekstenzije iznosila je 118,64° ± 11,42°, dok je postoperativno vrednost ovog opsega bila 128,63° ± 7,77°. Utvrđena je statistički značajna razlika u vrednostima VAS skora i opsega pokreta pri fleksiji i ekstenziji pre i posle operacije.

Anteriorna subkutana transpozicija ulnarnog nerva efikasna je hirurška metoda lečenja, koja povećava opseg pokreta u laktu kod bolesnika sa sindromom kubitalnog tunela.

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Ključne reči: *kubitalni tunel, ulnarni nerv, dekompresija*