ACTA
ORTHOPAEDICA
et
TRAUMATOLOGICA
TURCICA

Author's translation
Acta Orthop Traumatol Turc 2004;38(5):330-336

The mid-term results of minimal medial epicondylectomy and decompression for cubital tunnel syndrome

Kubital tünel sendromunda minimal medial epikondilektomi ve dekompresyon uygulamasının orta dönem sonuçları

Bulent EROL, Cihangir TETİK, Evrim SIRIN

Orthopaedics and Traumatology Department, Hospital of Marmara University

Amaç: Kubital tünel sendromu tanısıyla minimal medial epikondilektomi ve dekompresyon uygulanan hastalarda orta dönem izlem sonuçları değerlendirildi.

Çalışma planı: Kubital tünel sendromu tanısıyla minimal medial epikondilektomi ve in situ dekompresyon uygulanan 15 hastanın (9 kadın, 6 erkek; ort. yaş 45; dağılım 35-63) 17 dirseği geriye dönük olarak incelendi. Tanı, tüm hastalarda öykü, fizik muayene ve elektrodiagnostik testlerle kondu. Tüm hastalarda ameliyattan önce en az altı ay süreyle uygulanan çeşitli konservatif tedavi yöntemlerinden yarar sağlanamamıştı. Ulnar sinir tutulumu 13 hastada tek taraflı, iki hastada iki taraflı idi. Tutulum 11 dirsekte dominant taraftaydı. Ameliyat anına kadar şikayetlerin ortalama süresi 14 aydı (dağılım 8-36 ay). Ameliyat öncesinde, McGowan sistemine göre üç hastada (%20) derece I, 11 hastada (%73.3) derece II, bir hastada (%6.7) derece III sinir sıkışması vardı. Cerrahi tedavinin sonuçları Wilson-Krout ölçütleriyle değerlendirildi. Hastalar ortalama 32 ay (dağılım 25-64 ay) süreyle izlendi.

Sonuçlar: Tüm hastalarda semptomatik iyileşme sağlandı. Sonuçlar 11 dirsekte (%64.7) mükemmel, beş dirsekte (%29.4) iyi, bir dirsekte (%5.9) orta olarak değerlendirildi. Hiçbir olguda ulnar sinirde paralizi veya subluksasyon, medial dirsek instabilitesi ve pronator-fleksör tutunma yerinde zayıflık gözlenmedi. Dört dirsekte osteotomi bölgesinde gelişen ağrı ve hassasiyet ortalama üç ay sonra kayboldu.

Çıkarımlar: Minimal medial epikondilektomi ve dekompresyon uygulaması, kubital tünel sendromunun tedavisinde güvenilir, etkili ve komplikasyon oranı düşük bir yöntemdir.

Anahtar sözcükler: Kubital tünel sendromu/komplikasyon/cerrahi; dekompresyon/cerrahi; dirsek; humerus; sinir sıkışma sendromları/cerrahi; hareket açıklığı, artiküler; ulnar sinir/cerrahi; ulnar sinir sıkışma sendromları/cerrahi.

Objectives: We evaluated the mid-term follow-up results of patients who were treated by minimal epicondylectomy and decompression for cubital tunnel syndrome.

Methods: The study included 17 elbows of 15 patients (9 females, 6 males; mean age 45 years; range 35 to 63 years) who underwent minimal medial epicondylectomy and in situ decompression for cubital tunnel syndrome, which was diagnosed through history, physical examination, and electrodiagnostic tests. Before surgery, all the patients received various conservative treatments for at least six months, with no beneficial effect. Thirteen patients had unilateral, two patients had bilateral involvement, with 11 elbows on the dominant side. The mean duration of symptoms was 14 months (range 8 to 36 months). Preoperative grading of nerve compression according to the McGowan system was as follows: three patients (20%) grade I, 11 patients (73.3%) grade II, and one patient (6.7%) grade III. The results of surgical treatment was evaluated according to the Wilson-Krout criteria. The mean follow-up was 32 months (range 25 to 64 months).

Results: Symptomatic improvement was achieved in all the patients. The results were excellent in 11 elbows (64.7%), good in five elbows (29.4%), and fair in one elbow (5.9%). None of the patients developed ulnar nerve palsy or subluxation, medial elbow instability, or weakness of the flexor-pronator origin. Pain and tenderness detected at the osteotomy site in four elbows disappeared after a mean of three months.

Conclusion: Minimal medial epicondylectomy and decompression was found to be a safe and effective method with a low complication rate in the treatment of cubital tunnel syndrome.

Key words: Cubital tunnel syndrome/complications/surgery; decompression, surgical; elbow; humerus; nerve compression syndromes/surgery; range of motion, articular; ulnar nerve/surgery; ulnar nerve compression syndromes/surgery.

Correspondance to: Bülent Erol, MD. İnönü Cad., Sümko Sitesi, K4-Blok, D: 8, 34736 Kozyatağı, İstanbul.
Phone: +90 0216 - 325 42 82 Fax: +90 0216 - 325 45 82 e-mail: bulerol@hotmail.com

Received: 30.01.2004 **Accepted:** 10.11.2004

Ulnar nerve compression at the elbow and cubital tunnel is very common, and mainly results from bone anomalies (osteofits, cubitis valgus), soft tissue mass (ganglion, tumor), narrowing by facial structures and subluxation of ulnar nerve on the medial epicondyle.[1] Pain is observed in the forearm and ulnar part of the hand and loss of sense is detected in the fourth and fifth fingers in the cases with mild compression while weakness, muscle atrophy and clawhand deformity may be observed in advanced conditions. Symptoms becoming permanent cause remarkable restriction in the functions of the upper extremities.

Various conservative and surgical methods have been used in the treatment of ulnar nerve compression at the elbow. Main surgical options include in situ decompression and anterior transposition of the ulnar nerve and medial epicondylectomy. The medial epicondylectomy is an effective method in treating the cubital tunnel syndrome; however, it has some disadvantages such as causing medial instability and bone loss, development of postoperative tenderness in the site of the osteotomy, subluxation of the ulnar nerve and weakness of flexor-pronator origin. [2-6] In order to minimize such disadvantages, it has been suggested that the ulnar nerve decompression should be carried out by minimal medial epicondylectomy, which is a modification of the conventional procedure.[5,7]

In this study, we retrospectively evaluated the mid-term results in patients who underwent minimal medial epicondylectomy and in situ decompression due to non-responding cubital tunnel syndrome.

Patients and method

Medial epicondylectomy and in situ decompression were performed in seventeen elbows of 15 patients (9 females and 6 males; mean age 45 years; range 35 to 63 years) between 1996 and 2001 for the cubital tunnel syndrome not responding to conventional treatment. The patients were evaluated through history, physical examination and electrodiagnostic tests. The profession of the patients was as follows; three instructors, three secretaries, four officers, two nurses, and the remaining three were retired. The ulnar nerve involvement was unilateral in 13 patients (right in 8, left in 5) and bilateral in two patients. The involvement was at the dominant side in 11 elbows. Although the cause of ulnar nerve involvement was not detected in most of the patients (11 patients), recurrent pain activity requiring elbow flexion was found in three, and a traumatic event (olecranon fracture) in one of the patients. It has been revealed by clinical and laboratory tests (electrodiagnostic tests) that no neuropathy of peripheric nerve compression was present other than ulnar nerve compression at the elbow.

The mean duration of the complaints was 14 months (range 8 to 36 months) before the operation time. All patients had pain in the forearm distal, wrist and ulnar part of the hand, and loss of sensitivity at the fourth and fifth fingers. During the physical examination, a mild numbness in mostly ulnar part of the fourth and fifth fingers and a positive Tinel sign at the elbow level (not at wrist) were found. It was observed that the numbness in the fourth and fifth fingers increased when the arm was hold at full flexion at the elbow level for a period of nearly 30 seconds. Almost half of the patients had various degrees of weakness in the muscles of affected site, and one had muscle atrophy. No clawhand deformity was observed in the fingers in any of the patients.

Presence of any bone pathology, which may cause nerve entrapment, was examined by bilateral (postanterior and lateral) elbow radiographies. None of the cases had osteoid formation or an abnormal valgus carrying angle. All patients underwent electrodiagnostic tests-electroneuromyography; and these examinations revealed some abnormalities in 15 elbows.

The preoperative involvement grades were evaluated according to the McGowan system.[8] Findings were consistent with entrapment due to ulnar compression at the elbow level, which has an influence on daily and occupational activities, and the compression was regarded as grade I in patients with normal electromyography and nerve transmission findings (three patients, 20%). In patients with grade II compression (eleven patients, 73,3%), weakness in the muscles of the affected site was observed and abnormal results were obtained in the two-points differentiation test. And, one patient with remarkable atrophy and advanced numbness in the muscles (6,7%) was considered to have grade III nerve compression. Two patients with bilateral involvement had grade II nerve compression. The clinical findings were totally consistent with the cubital tunnel syndrome in two patients who had normal electrodiagnostic test results. Those two patients and another patient who was detected to have a weak ulnar nerve involvement by electroneuromyography were included in the group of grade I of the McGowan system.

Conservative methods were applied in all patients preoperatively at least for a period of six months (range 6 to 12 months) including activity modification, night splint and nonsteroid anti-inflammatory and corticosteroid medications; however none had beneficial effect. The pre- and post-operative examinations and surgery of the patients, who were recommended to undergo minimal medial epicondylectomy and in situ decompression, were all carried out by the same surgeon (CT). Two patients with bilateral involvement were operated successively at three months; firstly the arm with obvious symptoms and findings, and then the other arm were operated.

Surgical technique

Eleven elbows were operated under axillary block, and others under general anesthesia. Hemostatis was obtained by tourniquet, and a medial incision was performed, starting from 8 cm proximal and extending to the 8 cm distal of the medial epicondyle (Figure 1a). Skin and subcutaneous tissues were passed through paying specific attention to the medial antebracial cutaneous nerves. Following the successful relief of the ulnar nerve from the medial intermuscular septum, the septum was released and excised (Figure 1b). After releasing the arcade of Struthers in the proximal, the nerve was freed by advancing the ulnar nerve dissection toward the proximal and distal (Figure 1c). The aponeurosis of flexor carpi ulnaris and cubital tunnel were released while whole branches of ulnar and medial antebracial cutaneous nerves were maintained. Utmost care was given not to harm the blood circulation of the nerve.

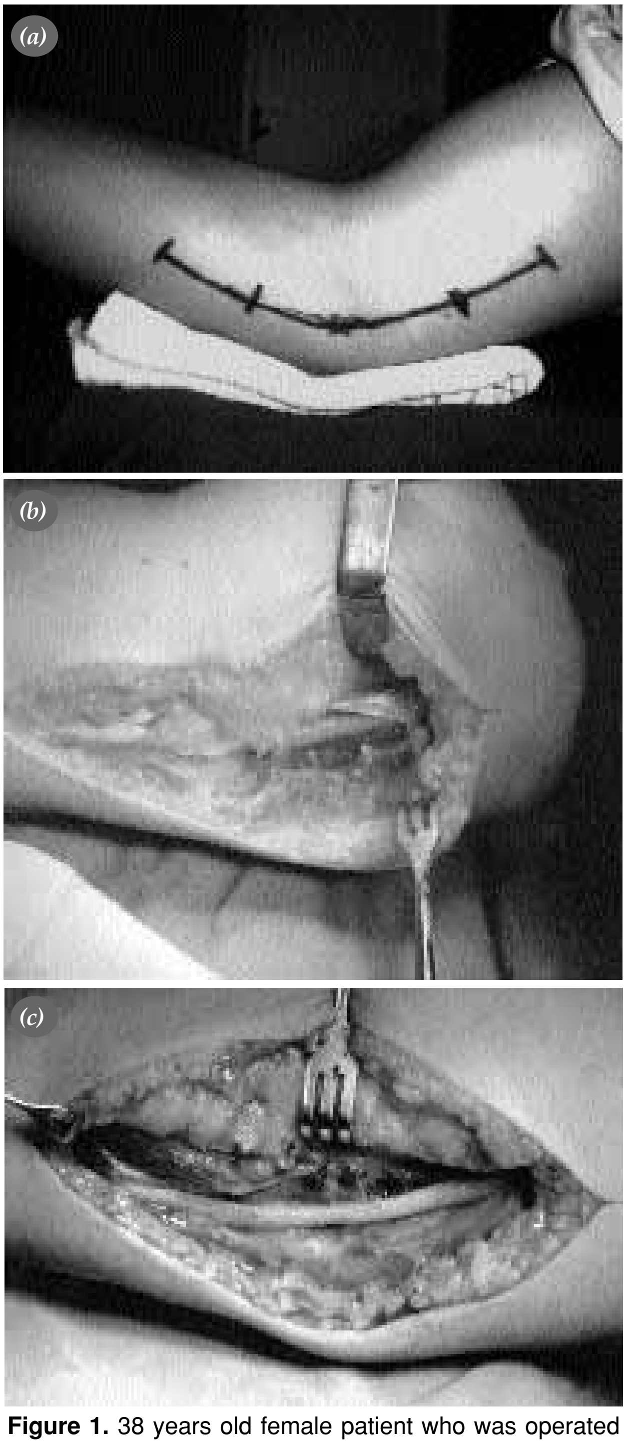

Figure 1. 38 years old female patient who was operated for the cubital tunnel syndrome at the elbow. (a) The skin was incised at the elbow medial, starting from 8 cm proximal extending up to 8 cm distal of the epicondlyle. (b) After the medial of the ulnar nerve was isolated under the intermuscular septum, the nerve was released by advancing the dissection toward the proximal and distal. (c) Subsequently, the medial epicondyle was osteotomized, and the top of this site was closed by the suturation of the periost flap, which was previously slipped off the epicondyle.

Then, a subperiosteal dissection was performed, incising through the point where the flexor-pronator muscle attachs to the medial epicondyle, which was followed by the initiation of the medial epicondylectomy. By osteotom (0.8 mm) the medial collateral ligament in the medial epicondyle was maintained, and the bone was resected enough to maintain the sliding of the ulnar nerve forward and backward on the epicondyle. After all the sharp edges at the osteotomy site were removed, the dissected periost was sutured onto this site (Figure 1c). A final examination confirmed that the nerve was not compressed by the medial epicondyle particularly during the flexion of the elbow since it slided easily on a smooth surface. The tourniquet was removed, bleeding was controlled, and the wound was closed in accordance with the tissue layers. The wound was dressed, and no splint was used. Motion activities were initiated right after the operation. The sutures were removed at the end of the postoperative week 1.

The patients, whose postoperative follow-ups were done at our clinic, were examined for complications and motion range of the elbow every week during the early period (6 weeks). Then, they were evaluated at months 3,6 and 12, followed by annual examinations. The results of the surgical treatment were classified as excellent, good, fair and poor based on the Wilson-Krout criteria.[9] Achieving a normal elbow was the excellent result while removal of symptoms, but persistence of a local tenderness from time to time was considered a good result. Along with a remarkable improvement in the symptoms, mild or moderate (less severe than the preoperative level) persistence or recurrence of the sense and motor symptoms or both was regarded as a fair result while absence of any improvement or worsening of the symptoms was evaluated as a poor result. The mean follow-up period for patients was 32 months (range 25 to 64 months). Statistical analyses were performed by the one-way ANOVA method.

Results

Symptomatic improvement was achieved in all patients following the surgical treatment. The results were excellent in 11 elbows (64.7%), good in five elbows (29.4%), and fair (5.9%) in one elbow. Excellent-good results were obtained in patients with a preoperative lower involvement grade (McGowan grades I and II). Fair result was obtained in one patient with advanced nerve entrapment. The elevated intrinsic muscle functions, muscle mass and sense functions were determined by objective measurements in this patient. It was demonstrated that there was no significant difference between the surgical results in terms of parameters like gender, dominant extremity, preoperative duration of the symptoms, electrodiagnostic tests with abnormal results and involvement grade in accordance with the McGowan system ($p>0.05$).

Full motion range was achieved in all of the elbows after the operation. No ulnar nerve palsy and subluxation or medial elbow instability was observed. Clinically there was no weakness in the pronator-flexor origin. The mild pain and tenderness in the osteotomy site observed in four patients spontaneously disappeared in a mean period of three months (range 1 to 6 months). No superficial or deep wound infection was seen.

Discussion

Ulnar nerve compression is the most common syndrome among the peripheral nerve entrapment neuropathies following the Carpal tunnel syndrome, and it usually occurs at the elbow. Several etiologic factors have been discussed and various treatment methods have been developed for this condition, which is called the Cubital tunnel syndrome.

Most of the reported cases are idiopathic. The leading one among all known mechanisms is the compression and entrapment effect of the natural or traumatic anatomic structures on the ulnar nerve.[1] Although no progression was observed in the conditions of our patients, the natural course would be the gradual progression of the symptoms, resulting in an inevitably irreversible damage in the nerve.

Even tough the prognosis is better and conservative treatment is well responded in acute cases, the prognosis is worse in chronic cases with advanced neurological deficit, and usually surgical treatment is required. McGowan[8] graded the cases with cubital tunnel syndrome according to its severity. This grading system, even tough it is partially subjective, determines the severity of the nerve damage occurred by evaluating the pain, sense, deformity and functions, and enables to make a good estimation about the potential feedback. Surgical treatment is indicated for chronic neuropathies grade I and over in the McGowan system. [8]

Several conservative and surgical methods have been developed for the treatment of cubital tunnel syndrome. Conservative approach includes activity modification, night splints, non-steroid, anti-inflammatory and corticosteroid medications. The objective of surgical procedures, which are applied when the conservative treatment fails, is to decompress the ulnar nerve in an appropriate way. The most common surgical treatment methods are the in situ decompression, anterior transposition and medial humeral epicondylectomy of the ulnar nerve.

Ulnar nerve can be decompressed by incision of the arcoid ligament (in situ simple decompression), which is an aponeurotic fibrotic band, composing the ceiling of the cubital tunnel.[10] Arcoid ligament extends from olecranon till the medial epicondyle, and composes the ceiling of the tunnel where the ulnar nerve passes through at the elbow level. This ligament with limited flexibility compresses the edematous or traumatized nerve. Furthermore, it may lead to narrowing of the tunnel due to the elevation of the troclear base during the flexion of the elbow, restricting the movement of the nerve toward the medial.[6]The incision of the arcoid ligament removes the compression, enabling the nerve to move without any restriction. In situ decompression has advantages like performing just a small incision and a restricted surgical dissection; these conditions do not influence the blood supply of the ulnar nerve too much. This method can be used in patients whose neuropathy is mild and bone anatomy is normal, and no pain is present at the site of the medial epicondyle and in situations where it was detected during the operation that the arcoid ligament is the cause of the compression.[1] Several studies compared the in situ decompression with the anterior transposition, and found out that the results are less successful. [11,12]

Subcutaneous, intramuscular or submuscular anterior transposition of the ulnar nerve inside the antecubital fossa is still a very common method. This method, which is effective in removing the compression-associated symptoms, has some significant disadvantages. Among those disadvantages, the major ones include remarkable reduction in the extrinsic blood vessels in the related part as a result of the anterior transposition of the ulnar nerve and frequently removal of the small, proximal branches of the nerve. Ogata and Naito [13] revealed that there was a remarkable reduction in the intraneural blood flow following the dissection of nerves, which are located at sites where the vesseling around the joint was intensive. The ulnar nerve is supplied well by the upper and lower collateral vessels from the rear recurrent ulnar artery inside the cubital tunnel. Those vessels are destroyed during the anterior transposition and the nerve relatively becomes hypovascular. It has been demonstrated that this hypovascularity lasted 3-7 days in experimental animals and longer in human beings depending on the anatomy of the vessel. [14] It has been suggested that this relative ischemia causes nerve dysfunction and in a way is responsible from the developing complications. [15,16]

Many studies have shown that conventional medial epicondylectomy is an effective method in treating the cubital tunnel syndrome.[3,4,5,17-20] Symptomatic improvement was reported over 90%, and excellent-good results between 56% and 74% by those studies. [3-5, 20] The major advantages of the medial epicondylectomy reported in the literature include removal or release of structures causing the compression (medial epicondyle, arcoid ligament, two heads of the flexor carpi ulnaris); less traumatization of the ulnar nerve and maintenance of the blood circulation; maintenance of small proximal nerve branches which are necessarily removed by other methods; enabling the nerve to move by confronting with smallest amount of obstacles on its way; and starting the arm activities at early postoperative period. However, the method also has some disadvantages like development of medial elbow instability, disappearance of the protective effect of the medial epicondyle, tenderness at the osteotomy site and weakness of the muscle strength of the flexor-pronator origin.

The problems developing after the medial epicondylectomy are mainly associated with the disappearance of the protective effect of the medial epicondyle; loss of the protective projection composed by the medial epicondyle makes the ulnar nerve more vulnerable to traumas. Symptoms can reoccur even after mild traumas.[7] O'Driscoll et al.[21] informed that the medial epicondyle can be excised at most 20% at the coronal plane without harming the anterior medial collateral ligament. Heithoff et al.[4] reported that they have established a grading system based on the postoperative radiographic analyses in patients who underwent medial epicondylectomy, and they evaluated the patients separately who were operated for complete, partial and minimal osteotomies. They indicated that in patients, who underwent complete osteotomy, mostly (81%) excellent-good results were obtained; in patients, who underwent minimal epicondylectomy, the success rate was remarkably decreased (50%) and all patients developed valgus instability at a rate of 43%. However, recent studies showed that the results of minimal epicondylectomy are similar to the results of complete epicondylectomy, and development of elbow instability is very rare.[7]

It has been reported that a persistent pain started at the operation site following the medial epicondylectomy, and tenderness developed.[5,6] Heithoff et al.[4] measured the strength of the flexor muscles of the forearm after the medial epicondylectomy, and found a reduction of 5% and 10% in the strengths for pinching and gripping, respectively. However, it has been agreed that such reductions are very mild losses of strength, and they are clinically hard to detect.

It has been reported that minimal medial epicondylectomy and ulnar nerve decompression are safe and effective in treating the cubital tunnel syndrome. This modified procedure was developed in order to minimize the potential disadvantages of the conventional medial epicondylectomy. Göbel et al. [7] performed minimal medial epicondylectomy and in situ decompression in 64 patients (66 elbows), and obtained excellent-good results in 79% of them. Same study highlighted that the complication rate was low, and this method was very effective in the treatment of the cubital tunnel syndrome; and they indicated that the main complication was the pain in the medial elbow, which was observed in 30% of the patients, even one year after the operation. Muermans and De Smet [22] obtained excellent-good results in 75% of 54 patients (60 elbows) who underwent partial medial epicondylectomy for cubital tunnel syndrome, and an improvement of at least one grade in 88.3% according to the McGowan criteria. It was also indicated that partial medial epicondylectomy is a successful surgical procedure in the treatment of the lesions of McGowan grades I and II, and the study also revealed a negative relation between the grade of the initial neurological involvement and the complete improvement.

All of our fifteen patients (17 elbows) had clinical improvement and 94% had excellent-good results. In parallel to the literature, better results were obtained in patients with initially lower rate of neurological involvement. The pain and tenderness in the osteotomy site were the main postoperative complaints; no complications such as ulnar nerve palsy and compression or medial elbow instability were experienced. The pain in the osteotomy site spontaneously disappeared in a shorter period (av. 3 months) than the one reported in the study by Göbel et al. [7]

Our study showed that minimal medial epicondylectomy and in situ decompression is a safe and effective method in treating the cubital tunnel syndrome. Excellent-good results were obtained in most of the patients; and as complication, all patients had pain and tenderness, which were restricted with the osteotomy site only and completely disappeared within a few months after the operation. Minimal medial epicondylectomy allows decompression of all sites with nerve entrapment, and move the nerve to front of the epicondyle without having any additional instability or devascularization risk. Potential complications can be highly prevented by correct implementation of the technique and an appropriate postoperative follow-up schedule.

References

1. Khoo D, Carmichael SW, Spinner RJ. Ulnar nerve anatomy and compression. Orthop Clin North Am 1996;27:317-38.
2. Dellon AL. Review of treatment results for ulnar nerve entrapment at the elbow. J Hand Surg [Am] 1989;14:688-700.
3. Froimson AI, Anouchi YS, Seitz WH Jr, Winsberg DD. Ulnar nerve decompression with medial epicondylectomy for neuropathy at the elbow. Clin Orthop 1991;(265): 200-6.
4. Heithoff SJ, Millender LH, Nalebuff EA, Petruska AJ Jr. Medial epicondylectomy for the treatment of ulnar nerve compression at the elbow. J Hand Surg [Am] 1990;15:22-9.
5. Kaempffe FA, Farbach J. A modified surgical procedure for cubital tunnel syndrome: partial medial epicondylectomy. J Hand Surg [Am] 1998;23:492-9.
6. Manske PR, Johnston R, Pruitt DL, Strecker WB. Ulnar

nerve decompression at the cubital tunnel. Clin Orthop 1992;(274):231-7.

7. Gobel F, Musgrave DS, Vardakas DG, Vogt MT, Sotereanos DG. Minimal medial epicondylectomy and decompression for cubital tunnel syndrome. Clin Orthop 2001;(393):228-36.
8. McGowan AJ. The results of transposition of the ulnar nerve for traumatic ulnar neuritis. J Bone Joint Surg [Br] 1950;32: 293-301.
9. Wilson DH, Krout R. Surgery of ulnar neuropathy at the elbow: 16 cases treated by decompression without transposition. Technical note. J Neurosurg 1973;38:780-5.
10. Osborne GV. The surgical treatment of tardy ulnar neuritis. J Bone Joint Surg [Br] 1957;39:782.
11. Adelaar RS, Foster WC, McDowell C. The treatment of the cubital tunnel syndrome. J Hand Surg [Am] 1984;9:90-5.
12. Foster RJ, Edshage S. Factors related to the outcome of surgically managed compressive ulnar neuropathy at the elbow level. J Hand Surg [Am] 1981;6:181-92.
13. Ogata K, Naito M. Blood flow of peripheral nerve effects of dissection, stretching and compression. J Hand Surg [Br] 1986;11:10-4.
14. Ogata K, Manske PR, Lesker PA. The effect of surgical dissection on regional blood flow to the ulnar nerve in the cubital tunnel. Clin Orthop 1985;(193):195-8.
15. Broudy AS, Leffert RD, Smith RJ. Technical problems with ulnar nerve transposition at the elbow: findings and results of reoperation. J Hand Surg [Am] 1978;3:85-9.
16. Campbell JB, Post KD, Morantz RA. A technique for relief of motor and sensory deficits occurring after anterior ulnar transposition. Technical note. J Neurosurg 1974; 40:405-9.
17. King T, Morgan FP. Late results of removing the medial humeral epicondyle for traumatic ulnar neuritis. J Bone Joint Surg [Br] 1959;41-B:51-5.
18. Goldberg BJ, Light TR, Blair SJ. Ulnar neuropathy at the elbow: results of medial epicondylectomy. J Hand Surg [Am] 1989;14(2 Pt 1):182-8.
19. Seradge H, Owen W. Cubital tunnel release with medial epicondylectomy: factors influencing the outcome. J Hand Surg [Am] 1998;23:483-91.
20. Tada H, Hirayama T, Katsuki M, Habaguchi T. Long term results using a modified King's method for cubital tunnel syndrome. Clin Orthop 1997;(336):107-10.
21. O'Driscoll SW, Jaloszynski R, Morrey BF, An KN. Origin of the medial ulnar collateral ligament. J Hand Surg [Am] 1992; 17:164-8.
22. Muermans S, De Smet L. Partial medial epicondylectomy for cubital tunnel syndrome: Outcome and complications. J Shoulder Elbow Surg 2002;11:248-52.