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Clinical Article

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Simple Decompression of the Ulnar Nerve for Cubital Tunnel Syndrome

Objective : Cubital tunnel syndrome is the second most common entrapment neuropathy of the upper extremity. Although many different operative techniques have been introduced, none of them have been proven superior to others. Simple cubital tunnel decompression has numerous advantages, including simplicity and safety. We present our experience of treating cubital tunnel syndrome with simple decompression in 15 patients.
Methods : According to Dellon's criteria, one patient was classified as grade 1, eight as grade 2, and six as grade 3. Preoperative electrodiagnostic studies were performed in all patients and 7 of them were rechecked postoperatively. Five patients of 15 underwent simple decompression using a small skin incision (2 cm or less).
Results : Preoperative mean value of motor conduction velocity (MCV) within the segment (above the elbow-below the elbow) was 41.8±15.2 m/s and this result showed a decrease compared to the result of MCV in the below the elbow-wrist segment (57.8±6.9 m/s) with statistical significance ($p<0.05$). Postoperative mean values of MCV were improved in 6 of 7 patients from 39.8±12.1 m/s to 47.8±12.1 m/s ($p<0.05$). After an average follow-up of 4.8±5.3 months, 14 patients of 15 (93%) reported good or excellent clinical outcomes according to a modified Bishop scoring system. Five patients who had been treated using a small skin incision achieved good or excellent outcomes. There were no complications, recurrences, or subluxation of the ulnar nerve.
Conclusion : Simple decompression of the ulnar nerve is an effective and successful minimally invasive technique for patients with cubital tunnel syndrome.

KEY WORDS : Cubital tunnel syndrome · Ulnar nerve · Simple decompression.

INTRODUCTION

Cubital tunnel syndrome is the second most common peripheral compression neuropathy in the upper extremity after carpal tunnel syndrome[8,9]. Numerous etiologies include external trauma, pressure, bony impingement, irregularities in muscles, subluxation of the ulnar nerve over the medial epicondyle, ganglia, and congenital abnormalities such as cubitus valgus[11,30].

Treatment modalities include nonoperative management and operative procedures. Nonoperative treatment has shown to be effective in many early cases[9]. Operative treatment is indicated for failed cases of nonoperative treatment and for neurological deficits[17,20]. Surgical options available for cubital tunnel syndrome have evolved through many years[5,9,15,18,20,22,25,30]. These fall into 2 categories. The first category includes in situ (or simple) decompression with or without epicondylectomy[14,15,18,25,26,31]. The second category includes the anterior transposition procedures (subcutaneous, intramuscular, and submuscular)[9,12,17,20,22]. However, the choice of surgical treatment still remains controversial and all procedures show similar success rates[2,6,13,24]. Several authors also have reported good to excellent results with simple decompression[5,14,23,25,26,31].

Surgical procedure for conventional simple deroofing of the ulnar nerve is needed for a relatively long incision, about 6-8 cm above and below the elbow. Recently, we have performed this procedure using a small skin incision (2 cm or less) in five consecutive patients.

We report both preoperative clinical findings and surgical results of 15 patients. Also, we will discuss reason why simple decompression is recommended as an alternative to transposition procedures in most patients of cubital tunnel syndrome.

MATERIALS AND METHODS

Eighteen patients underwent operative treatment for cubital tunnel syndrome in our department from 2003 to 2006. Three patients were excluded from this study : two had been treated by subcutaneous transposition and the other had been treated by submuscular

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Table 1. Dellon's classification of cubital tunnel syndrome

	Mild (I)	Moderate (II)	Severe (III)
Sensory	Intermittent paresthesia	Intermittent paresthesia	Permanent paresthesia
Motor	Subjective weakness	Measurable weakness	Palsy
No. of patients in this study	1 (7%)	8 (53%)	6 (40%)

Table 2. Modified Bishop's scoring system

	Points
Satisfaction	
Satisfied	2
Satisfied with reservation	1
Dissatisfied	0
Improvement	
Better	2
Unchanged	1
Worse	0
Severity of residual symptoms	
Asymptomatic	3
Mild, occasional	2
Moderate	1
Severe	0
Work status	
Working or able to work at previous job	1
Not working because of ulnar neuropathy	0
Leisure activity	
Unlimited	1
Limited	0
Strength	
Intrinsic muscle strength normal (M5)*	2
Intrinsic muscle strength reduced to M4	1
Intrinsic muscle strength less than or equal to M3	0
Sensibility (static two point discrimination)	
Normal (≤6 mm)	1
Abnormal (≥6 mm)	0
Total	12

*Medical council grading

transposition in early period of this series. Remaining 15 patients were evaluated with a mean follow-up 4.8±5.3 (range, 1-18) months. Despite conservative treatment, all patients had continuous numbness or tingling in the ring and little fingers with or without motor deficits, and/or persistent pain along the ulnar border of the hand and forearm, at times extending into the shoulder. Each patient was examined preoperatively and the following data were evaluated; initial chief complaint, duration of symptoms, Tinel's sign around the elbow, provocation test by the elbow flexion test, and the results of the electrodiagnostic studies.

The patients' preoperative clinical manifestations were determined with Dellon's staging system[7] (Table 1). Eight out of 15 patients were graded as 2 (moderate syndrome), six were graded as 3 (severe syndrome), and one as grade 1 (mild syndrome). All patients were examined with standard radiographs of the elbow preoperatively. Radiographs of 3 of the 15 elbow joints disclosed mild osteoarthritic changes, but none of these patients experienced any symptoms related to the osteoarthritis. Exclusion criteria of this simple decompression included severe cubital valgus or elbow deformity, moderate to severe osteoarthritis of the elbow, and recurrent compression after previous surgery. Significant cervical spine disorders were also excluded.

Preoperative electromyography of the flexor carpi ulnaris, abductor digiti minimi, and first dorsal interosseous muscle were done in all patients. Preoperative motor conduction velocity (MCV) of the ulnar nerve in the segments of axilla-above the elbow, below the elbow-wrist, and within the segment (above the elbow-below the elbow) were also evaluated in all patients bilaterally and compared with those of the intact segment (ipsilateral below the elbow-wrist). An inching technique between 4 cm distal and 6 cm proximal to the medial epicondyle was also simultaneously applied to all of the patients to determine the exact location of the compression site. Postoperative MCV of the ulnar nerve in the affected limb was examined 1 and 3 months using the same tests in 7 of 15 patients. The obtained data were compared with the preoperative results.

Postoperative clinical outcome was assessed in all patients according to a modified Bishop scoring system, excellent score as above 8 points out of the 12 points scoring system, good between 5 to 7, fair between both 3 and 4, and poor as below 2[19,27] (Table 2).

The operative procedure for conventional simple decompression was performed under the axillary regioned anesthesia using a pneumatic tourniquet. The arm was externally rotated and the elbow flexed to 90 degrees. Approximately 6 to 8 cm long curved skin incision, above and below the elbow, was made posterior to the medial epicondyle of the humerus. When the overlying subcutaneous tissues were retracted and divided, overlying constricting fascia and the ulnar nerve could be seen. The nerve was released proximally as it passed through the medial intermuscular septum. The cubital tunnel retinaculum and flexor carpi ulnaris aponeurosis were then cut distally for a distance of 5 to 7 cm, which allowed for simple decompression of the ulnar nerve at the elbow (Fig. 1). The wound was closed with usual manners. Early rehabilitation including flexion and extension of the elbow, but not supination and pronation, were encouraged.

The same procedure was followed initially for simple decompression with a small skin incision. The medial epicondyle and the olecranon were marked and a skin incision of approximately 2 cm was performed between

Fig. 1. Intraoperative finding of simple decompression in left elbow using an early long incision shows hyperemic and bluish color change (black arrow) of decompressed ulnar nerve at the entrapment site.

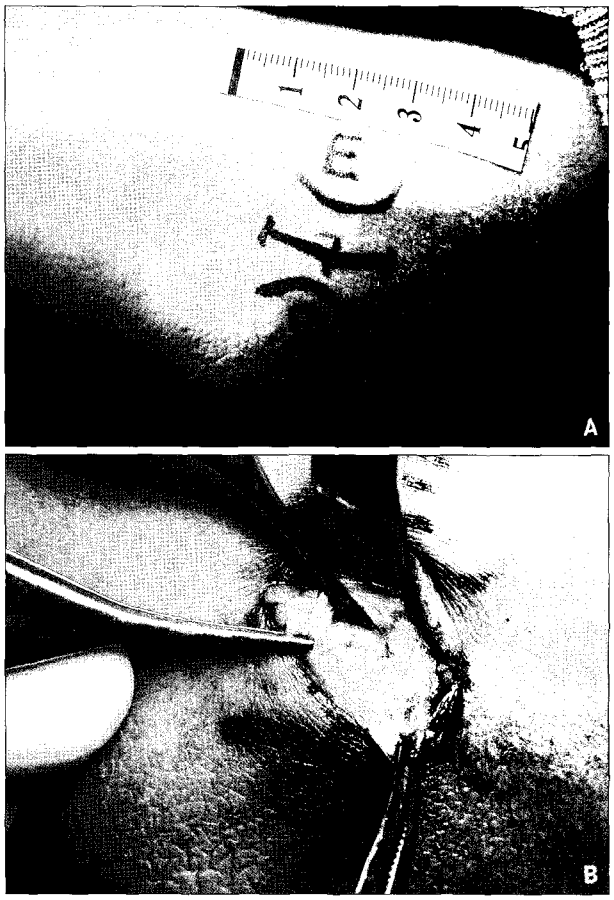

Fig. 2. A : Skin marking at right elbow for simple decompression of ulnar nerve using a small incision. A 2 cm skin incision made between the medial epicondyle (E) and olecranon (O). B : Intraoperative photograph demonstrating the ulnar nerve and overlying fascial membranes within the cubital tunnel.

them (Fig. 2A). After retraction of the subcutaneous tissue, Osborne's ligament was identified and released. Then the skin was retracted proximally and distally, and overlying fascia of the ulnar nerve was released (Fig. 2B). The same degree of exposure at the entrapment site could be obtained with this small skin incision.

Statistical analysis was performed using SPSS software (version 11.0, Chicago, Illinois). The Wilcoxon signed ranks test was used to assess any significant difference between preoperative and postoperative data. A p-value of 0.05 or less was considered significant.

RESULTS

There were 9 men and 6 women, with a mean age of 44.3±16.5 (range 18-79) years. The operation was performed on 6 right and 9 left elbows. None of our patients had bilateral symptoms. Preoperative chief complaints were paresthesia in 9 and paresthesia with weakness in 6. The mean duration of symptom before surgery was 6.1 (range, 1-24) months. No definite etiologic factors were found in 13 patients (87%) whereas, in 2 patients (13%), a previous injuries were noted. None of the patients' elbows showed valgus or varus deformity compared with the opposite elbows. The cubital tunnel syndrome showed on the dominant side in 10 patients and on the non-dominant in 5. Tinel's sign was positive in 13 patients (87%) and the provocation test was positive in all patients.

Preoperative electrodiagnostic abnormalities were seen in 14 of 15 limbs which underwent from MCV examinations across the elbow segment of the ulnar nerve. This mean value of MCV within the segment was 41.8±15.2 m/s and it was decreased than the value of MCV in the below the elbow-wrist segment of the involved limbs (57.8±6.9 m/s) with statistically significant difference ($p<0.05$). The percent reduction in MCV compared to the segment from below the elbow to the wrist was 30% (range, 0% to 62%) and was diminished by more than 33% in 8 patients. The mean value of MCV in the grade 2 group according to Dellon's classification was 41.7±11.6 m/s and the grade 3 group was 35.3±10.1 m/s ($p>0.05$). The remaining one patient with a normal MCV value had typical symptoms and signs consistent with the cubital tunnel syndrome.

Postoperative electrophysiological study was assessed in 7 patients. In 6 of these patents (86%), the mean value of MCV had improved with statistical significance from 39.8±12.1 m/s to 47.8±12.1 m/s ($p<0.05$). The one patient who had not shown improvement in the postoperative result of MCV had the longest duration of the symptom before surgery (24 months) among all patients.

According to a modified Bishop scoring system, 11 patients (73.3%) were clinically graded as excellent (five scored 12, three scored 11, two scored 10, and one scored 9), 3 (20%) were graded as good (scores of 7), and 1 (6.7%) was graded

Table 3. Surgical results

	Dellon I (n=1)	Dellon II (n=8)	Dellon III (n=6)	Total
Bishop rate				
Excellent	1	7	3	11 (73.3%)
Good	0	0	3	3 (20%)
Fair	0	1	0	1 (6.7%)
Poor	0	0	0	0 (0%)

as fair (Table 3). The patient with a fair grade had not shown improvement in the postoperative MCV. None of the cases were evaluated as poor. Patients who had been treated using a small skin incision achieved good (1 patient) or excellent (4 patients) outcome. Neither severe complications nor recurrences were observed during the follow-up period.

DISCUSSION

There is a controversy as to the best treatment option for cubital tunnel syndrome. Numerous literatures have not shown any definitely superior procedure for decompression among the surgical modalities including simple decompression and anterior transposition procedures (subcutaneous, intramuscular, and submuscular)[5,7,9,10,14,19,24]. However, many authors have reported that simple decompression is the surgical procedure of choice for most cases of cubital tunnel syndrome[6,10,24-26,31]. Others also advocate that anterior transposition of ulnar nerve is not only unnecessary for the successful treatment, but that it may often be harmful and has potential complications[14,15]. Several comparative studies between simple decompression versus anterior transposition have demonstrated that there are no significant differences between the outcomes of the two groups[5,6,24]. Our opinion, like that of other authors, is that if all surgical techniques yield similar success rate, the choice of surgical technique should be based on simplicity[14,26,31]. Simple decompression has many advantages compared to anterior transposition techniques. First, simple decompression is technically simple and does not influence the blood supply of the ulnar nerve[1,24]. Second, it is also effective because it addresses the primary focus of the lesion, the cubital tunnel. Third, it has lower rate of postoperative complications and more opportunities for quicker rehabilitations[14,24]. Simple decompression, however, is not appropriate in a poor bed, severe cubitus valgus, or a subluxing nerve[14,22,30].

Medial epicondylectomy has been a successful surgical method to treat cubital tunnel syndrome. This allows complete decompression of ulnar nerve and can be considered as a mini-anterior transposition without the disadvantage of devascularizing the nerve[23]. However, several complications have been reported including tenderness, postoperative pain, flexor pronator weakness, and valgus instability[1,23]. Muermans et al. reported that postoperative residual pain was present in 21 of 51 patients and most commonly over the osteotomy site or due to sensory branch nerve injury[23]. Although the medial epicondylectomy has some advantages over anterior transpositions, it is not familiar with most neurosurgeons and it has its own drawbacks.

Tests of MCV at different sites along the ulnar nerve are very helpful in diagnosing cubital tunnel syndromes. Normal value of MCV measured by from proximal to the elbow to the level of wrist has been reported to be 61.4 ± 6.5 m/s[21]. MCVs that are decreased by more than 33% or 10 m/s in the above the elbow to below the elbow segment compared with the below the elbow to wrist segment are considered significant and suggestive of cubital tunnel syndrome[3,28]. In general, slowing of conduction velocity is directly proportional to the duration and severity of the compression[22,24,26,30]. In the present study, the preoperative MCV of the segment of above the elbow-below the elbow was diminished in eight of fifteen patients by more than 33% compared with the segment of below the elbow-wrist. Group classified as severe by Dellon's classification also revealed more serious conduction delay than moderate group with statistical significance ($p<0.05$).

Authors used an inching technique to determine the exact location of the pathological compression of the ulnar nerve in all patients before surgery. This technique can locate the site of entrapment of the ulnar nerve from the arcade of Struthers to confluence of the 2 heads of the flexor carpi ulnaris[29]. Inching is measured by marking off 1 cm increments from 4 cm below the elbow to 6 cm above the elbow. Several studies with the inching technique stated that the lesions located to be at or just proximal to the cubital tunnel 80% to 96%[4,16,29]. In the present study, the compression sites utilizing this inching technique also located within the cubital tunnel in all patients. It supports a reason to choose the simple decompression as a surgical procedure for treatment of cubital tunnel syndrome.

According to the previous clinical studies, conservative treatment proved to be beneficial in approximately 90% of patients with mild symptoms[9,22,30]. Therefore, Dellon's grade 1 cubital tunnel syndrome (symptoms only) with normal electrodiagnostic studies and absence of intrinsic muscle weakness may be viewed as contraindications to operative intervention. However, negative electrodiagnostic studies do not rule out the diagnosis of cubital tunnel syndrome[32]. More advanced neuropathy and increased delays in conduction velocity are associated with poor clinical outcome regardless of surgical treatment[7,22,24,26]. Authors performed simple decompression for an eighteen-year-old female patient who had cubital tunnel syndrome with normal electrodiagnostic studies and failed to the

conservative treatment. The previous symptoms were immediately disappeared after surgery. She could return to work 2 weeks after surgery without specific complications.

Six of fifteen patients who were graded as severe according to Dellon's staging system underwent simple decompression of the ulnar nerve at the elbow. Simple decompression resulted in good or excellent postoperative relief of symptoms in 93% of cases after an average follow-up of 4.8 months in this series. Even patients who were graded as severe, thus usually not recommend for simple decompression[7,22], achieved good or excellent results in all patients. The only one patient who scored fair outcome by a modified Bishop scoring system had the longest duration of symptoms. Although Nathan et al.[26] reported that the duration of ulnar nerve symptoms did not predict outcome, several studies have demonstrated that the outcome is affected by the duration of symptoms[5].

Initially, operative procedure consisted of simple deroofing of the ulnar nerve, for 6 to 7 cm above and below the elbow using the same length of skin incision. Later, the skin incision was shortened to 2 cm or less as experiences accumulate. Authors were able to judge sufficient length of ulnar nerve and obtain similar clinical results to those of standard techniques using this small skin incision technique in the consecutive 5 patients.

Postoperative subluxation of the ulnar nerve has been reported as a statistically significant cause of failure of simple decompression[7,30]. However, Nathan et al.[26] only found three occurrences in his series of 164 cases. There was no postoperative subluxation of the ulnar nerve after simple decompression in the present study.

CONCLUSION

Many surgical procedures are advocated for the treatment of cubital tunnel syndrome. However, there have not shown any clearly superior procedure for decompression at the elbow. In situ (simple) decompression is technically simple and safe. Its application seems appropriate for patients regardless of severity of symptoms who remain unresponsive to conservative care. Authors have found simple decompression to be an effective and minimally invasive approach to ulnar neuropathy of the elbow.

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