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THE RELATION BETWEEN CUBITAL TUNNEL SYNDROME AND THE ELBOW ALIGNMENT

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INDEXING WORDS

cubital tunnel; ulnar nerve; nerve palsy; elbow joint; operative treatment

SYNOPSIS

The authors reviewed forty-three surgically managed cases of cubital tunnel syndrome treated during the past twelve years. Surgery had been performed on thirty-one men and twelve women. Their average age was 46.8 years old. The etiology of cubital tunnel syndrome had been determined as follows: There were twenty-three cases of osteoarthritis of the elbow joint. There were four cases of isolated cubitus valgus deformity. There were three cases of isolated cubitus varus deformity. There were three cases of rheumatoid arthritis. One patient had sustained trauma to the cubital tunnel. In nine other patients there were various causes but no joint malalignment.

The selection of the surgical technique for the correction of cubital tunnel syndrome was a function of the etiology of the condition. Cubital tunnel syndrome from osteoarthritis was surgically managed with a modified King technique. Ulnar neuropathy with a cubitus valgus deformity was managed with an ulnar nerve anterior transposition. Ulnar neuropathy with a cubitus varus deformity was managed with a neurolysis.

The surgical outcome for cubital tunnel syndrome in patients with an angular

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deformity at the elbow frequently was not optimum. However, although some patients remained symptomatic, the majority of postoperative patients did obtain improved motor strength and conduction velocities. This confirmed the efficacy of surgical management regardless of the cubital tunnel syndrome etiology.

INTRODUCTION

Compression and dysfunction of ulnar nerve occurs in cubital tunnel syndrome. Despite multiple different etiologies cubital tunnel syndrome consistently results in ulnar neuropathy. Surgical management of cubital tunnel syndrome is indicated for patients who have not responded to conservative management. This is a retrospective study of patients surgically managed for cubital tunnel syndrome. The potential etiologies of the condition, optimum operative techniques, and surgical outcomes are analyzed and presented.

MATERIALS AND METHODS

The authors investigated forty-three patients who were surgically treated for cubital tunnel syndrome during a period of 1982 through 1994. Surgery had been performed on thirty-three men and twelve women. The right elbow was treated in twenty-six patients. The left elbow was treated in seventeen patients. The age of the patients ranged from fifteen to seventy-two years old. The average age was 46.8 years old. The follow-up period ranged from six months through ten years. The average follow-up period was two years eight months. The Akahori's classification system[1] was selected to evaluate the outcome of the patients. The postoperative results were classified as excellent, good, fair, or poor.

RESULTS

The forty-three patients in this study were divided into six groups. The first group contained twenty-three patients with osteoarthritis of the elbow. The second group contained four patients with cubitus valgus, but without osteoarthritis. The third group contained three patients with cubitus varus, but without osteoarthritis. The fourth group contained three patients with rheumatoid arthritis. The fifth group had a single patient with post-traumatic cubital tunnel syndrome after a fracture dislocation of the elbow. The sixth group contained nine patients that had various conditions responsible for cubital tunnel syndrome(Table Ⅰ).

Osteoarthritis of the elbow was the most frequent cause of cubital tunnel syndrome. The osteoarthritis group contained twenty-three patients. The

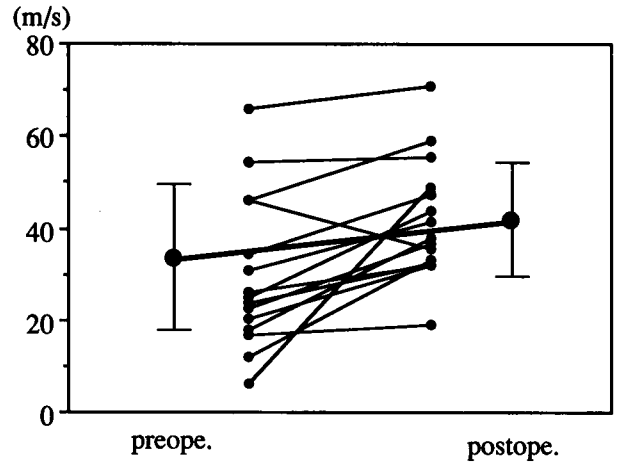

Figure 1. Ulnar nerve motor conduction velocity.

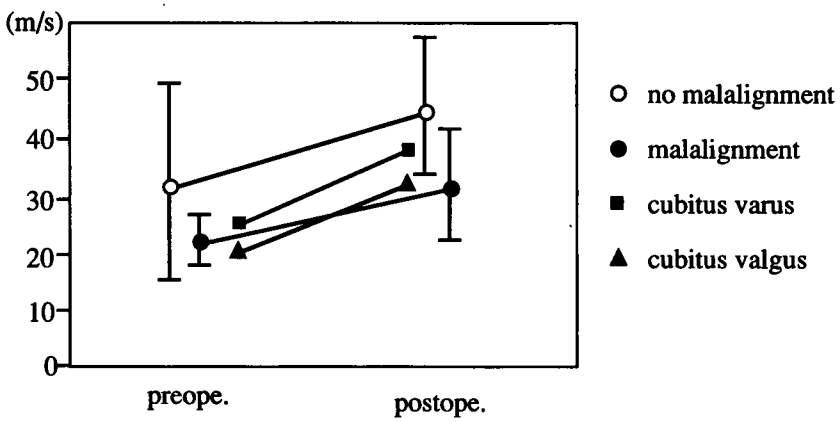

Figure 2. Pre and postoperative ulnar nerve motor conduction velocities and elbow alignments.

Table I. Etiology and surgical technique.

	modified King	anterior transposition	neurolysis
osteoarthritis(23cases)	15	7	1
cubitus valgus(4cases)	0	4	0
cubitus varus(3cases)	0	0	3
rheumatoid arthritis(3cases)	2	0	1
post-trauma(1case)	0	0	1
others(9cases)	4	3	2
total(43cases)	21	14	8

Table II. Etiology and results.

	excellent	good	fair	poor
osteoarthritis(23cases)	7	9	5	2
cubitus valgus(4cases)	0	2	1	1
cubitus varus(3cases)	1	1	0	1
rheumatoid arthritis(3cases)	1	0	2	0
post-trauma(1case)	0	1	0	0
others(9cases)	3	3	3	0
total(43cases)	12	16	11	4

Table Ⅲ. Alignment and results.

		excellent	good	fair	poor
no malalignment	(32cases)	11	11	9	1
malalgnment	cubitus valgus (7cases)	0	3	2	2
	cubitus varus (4cases)	1	2	0	1
		12	16	11	4

Table Ⅳ. Surgical technique and results.

	excellent	good	fair	poor
modified King(21cases)	9	8	4	0
anterior transposition(14cases)	2	4	5	3
neurolysis(8cases)	1	3	3	1
total(43cases)	12	15	12	4

Table Ⅴ. Interval until surgical management and results.

	~2 years	~4 years	~6 years	~8 years	~10 years	~12 years	total
excellent	9	3	0	0	0	0	12
good	11	3	1	0	0	1	16
fair	8	0	1	0	1	1	11
poor	1	1	1	0	1	0	4
total	29	7	3	0	2	2	43

osteoarthritis patients included a subgroup of three patients with a cubitus valgus deformity and one case of cubitus varus deformity.

The sixth group contained nine patients with various conditions responsible for development of cubital tunnel syndrome. Ulnar nerve friction neuritis was identified in three of these patients. There was one patient with cubital tunnel syndrome that resulted as a post-surgical complication after an internal fixation of a condylar fracture of humerus. The remaining five patients had cubital tunnel syndrome of undetermined etiology.

Three different surgical techniques were used in the treatment of the forty-three patients. The modified King technique of ulnar nerve decompression was performed on twenty-one patients[5]. Anterior transposition of the ulnar nerve was performed on fourteen patients, and eight patients received a neurolysis alone[3,4].

The patients who had osteoarthritis of the elbow were most frequently treated with the modified King technique. The patients with a cubitus valgus deformity were treated with anterior ulnar nerve transposition. The patients with a cubitus varus deformity or rheumatoid arthritis were treated with neurolysis. The patients who had osteoarthritis with cubitus valgus were treated with anterior ulnar nerve transposition. The patients who had osteoarthritis with cubitus varus were treated with neurolysis.

The motor nerve conduction velocities of the ulnar nerve were measured on all patients pre and postoperatively. The preoperative and postoperative measurements were then compared and analyzed(Figure 1). The postoperative motor nerve velocity showed improvement in all patients without one. The average velocity before surgery was 33.4 ± 16.0m/sec. The average velocity after surgery was 41.9 ± 12.4m/sec. A postoperative deterioration of the conduction velocity was observed in one patient. However, this patient also had cervical spondylosis which may have been responsible[7]. In all patients without one, a postoperative improvement in the motor nerve conduction velocity was determined regardless of the preoperative degree of the ulnar neuropathy.

The relationship between the preoperative etiology of the cubital tunnel syndrome and its outcome is shown in Table Ⅱ. In twenty-three patients with osteoarthritis, sixteen patients had good or excellent outcome. However, none of the four patients with isolated cubitus valgus received an excellent outcome; two patients had a fair or poor outcome. In three patients with osteoarthritis and cubitus valgus deformity, one patient had a good, one had a fair, and one had a poor outcome. In general, regardless of osteoarthritis, a cubital valgus deformity seemed to be a poor prognostic indicator.

In three patients with isolated cubitus varus, one patient had an excellent and one had a good outcome. This may suggest that the cubitus varus deformity has a

better potential prognosis than cubitus valgus. The single case of post-traumatic cubital tunnel syndrome had a good outcome.

The patients were classified into two groups dependent upon the presence of an elbow alignment abnormality. The pre and postoperative motor nerve conduction velocities in each patient and group were measured and compared to determine objective outcome information(Figure2). A comparison was also performed between the pre and postoperative motor nerve conduction velocities and the elbow alignments.

The average preoperative motor nerve conduction velocity in the group without malalignment was 32.4±18.8 m/sec. The average postoperative velocity improved to 45.3±12.1 m/sec. In contrast the groups with valgus or varus malalignment had an average preoperative motor nerve conduction velocity that was 22.7±4.2 m/sec. The average postoperative velocity improved to 31.9±10.2 m/sec. These measurements showed that the cubital tunnel syndrome associated with elbow malalignment was more severe and had less potential for postoperative improvement.

The group of cubitus valgus patients had an average preoperative motor nerve conduction velocity that was 20.1±5.0 m/sec. The average postoperative motor nerve conduction velocity was 25.7±9.3 m/sec. The group of cubitus varus patients had an average preoperative motor nerve conduction velocity that was 25.3±1.1 m/sec. The average postoperative motor nerve conduction velocity was 38.0±8.6 m/sec.

The outcome of the surgical management of the patients who had decompression with and without malalignment at the elbow regardless of surgical procedure were compared by using Akahori's classification scheme(Table Ⅲ). A good or excellent result was obtained in 69 % of the patients with normal elbow alignment, but in only 55 % of the patients with elbow malalignment. The decreased number of good or excellent results suggested that elbow malalignment is a potentially negative prognostic indicator. In the patients with cubitus valgus a fair or poor result was obtained in 57 % of the patients. This would indicate that a cubitus valgus deformity is a negative prognostic indicator.

The outcome of patient treated by the three different surgical technique is presented in Table Ⅳ . The modified King technique produced excellent and good results in seventeen of twenty-one patients. A comparison of the interval from the onset of symptoms until surgical management was performed is presented in Table Ⅴ. This analysis suggested that there was a better prognosis for patients who were treated early in the onset of cubital tunnel syndrome.

DISCUSSION

Cubital tunnel syndrome is a condition in which an ulnar neuropathy has developed from pathology at the elbow joint. Osteoarthritis of the elbow, rheumatoid arthritis, soft tissue neoplasms, elbow malalignments, and other conditions are the primary causative factors of cubital tunnel syndrome. Because of the presence of multiple conditions producing cubital tunnel syndrome, there are multiple operative procedures.

Recently, the modified King technique in which there is combined ulnar nerve neurolysis and medial epicondylectomy has gained popularity. However, an anterior transposition of the ulnar nerve is performed in patients with severe cubitus valgus. Transposition can correct the direction of the ulnar nerve which has been stretched in the cubitus valgus deformity. The position of the ulnar nerve cannot be corrected effectively with the modified King technique.

The relationship between the severity of the ulnar neuropathy and the malalignment of the elbow was investigated. The patients were classified into three groups dependent on elbow alignment as follows, the first group had patients with normal alignment, the second group had patients with cubitus valgus, the third group had patients with cubitus varus.

The average ulnar nerve motor conduction velocity in the patients with normal elbow alignment was 32.4 ± 18.8 m/sec. In patients with cubitus varus it was 25.3 ± 1.1 m/sec. In patients with cubitus valgus it was 20.1 ± 5.0 m/sec. Comparison of the measurements of the normal patients with the one of the cubitus varus patients was not significantly different. However, compared with the normal patients, the cubitus valgus patients had significantly diminished nerve conduction velocities.

In the patients with normal elbow alignment 69% achieved a good or excellent outcome. In the patients with cubitus varus alignment 75% achieved a good or excellent outcome. However, only 29% of the cubitus valgus patients had a good or excellent outcome. It had been presumed that the cubitus valgus deformity had advanced ulnar neuropathy because the nerve was stretched. The authors observed that patients with elbow malalignment, especially a cubitus valgus deformity, had advanced ulnar neuropathy and therefore had a worse outcome.

It had been presumed that patients with cubitus varus did not develop ulnar neuropathy. This presumption was founded in the understanding that the varus deformity produced decreased forces upon the ulnar nerve, whereas in the valgus deformity the nerve was stretched.

However, recent literature has documented ulnar neuropathy as a consequence of cubitus varus[2,6]. Cubitus varus and valgus are usually acquired deformities that occur after fracture of the elbow in childhood, therefore they had the almost same interval from the onset of symptoms until surgical management. The development

of tardy ulnar nerve palsy associated with cubitus valgus is well described. However, similar less severe tardy ulnar nerve palsy can develop in patients with cubitus varus. This has generally not been recognized due to the limited ulnar neuropathy symptoms in these patients. The authors observed that patients with a cubitus varus had a better outcome than patients with a cubitus valgus deformity.

Regardless of the preoperative etiology of the cubital tunnel syndrome, the postoperative ulnar motor nerve conduction velocity was improved. However, the degree of improvement appeared to be dependent on both the duration of the symptoms before surgical intervention and the alignment of the elbow.

Anterior transposition of the ulnar nerve is a generally accepted procedure for treatment of cubital tunnel syndrome. It is especially useful in patients with cubitus valgus where the ulnar nerve is pathologically stretched. Transposition permits correction of the position of the ulnar nerve and consequently can decrease stretch and stress upon the nerve.

Isolated neurolysis or neurolysis combined with medal epicondylectomy were considered good surgical procedures for patients with normal elbow alignment or patients with cubitus varus malalignment.

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