Hiroshi Hashiguchi · Hiromoto Ito
Takuya Sawaizumi

Stabilized subcutaneous transposition of the ulnar nerve

Accepted: 10 April 2003 / Published online: 12 June 2003
© Springer-Verlag 2003

Abstract We treated 50 patients (average age 47.9 years) with a stabilized subcutaneous transposition of the ulnar nerve. The average follow-up period was 42.4 months. The indication was cubital tunnel syndrome in 19 patients and injuries around the elbow in 31 patients. Postoperatively, satisfactory results were obtained in all the patients, and there was no complication or aggravation of the preoperative symptoms. None of the patients experienced slipping back of the nerve to the cubital tunnel. In the 31 patients with injuries around the elbow, there was only one patient with transient aggravation of parasthaesia in the ulnar nerve region. Stabilized subcutaneous transposition is a simple and less invasive procedure that can facilitate decompression and prevent slipping back of the nerve. This procedure also can be applied to patients with injuries around the elbow that require ulnar nerve transfer.

Résumé Nous avons traité 50 malades (âge moyen 47.9 années) avec une transposition sous-cutanée stabilisée du nerf cubital. La durée du suivi moyen était 42.4 mois. L'indication était un syndrome du tunnel cubital chez 19 malades et une blessure autour du coude chez 31 malades. Des résultats post-opératoires satisfaisants ont été obtenus pour tous les malades, et il n'y avait aucune complication ou aggravation des symptômes pré-opératoires. Aucun des malades n'a souffert du recul du nerf cubital en arrière. Chez les 31 malades avec une blessure, seulement un patient a eu une aggravation transitoire des paresthésies dans le territoire cubital. La transposition sous-cutanée stabilisée est une procédure simple et

moins envahissante qui peut faciliter la décompression et prévenir le déplacement du nerf en arrière. Cette procédure peut aussi être appliquée aux malades avec une blessure du coude qui exige un transfert cubital.

Introduction

From 1995, anterior transposition of the ulnar nerve using a noncompressing fasciadermal sling has been performed on patients who require ulnar nerve transfer due to cubital tunnel syndrome or injuries around the elbow; this method is called stabilized subcutaneous transposition and was first reported by Eaton et al. [4]. We reviewed a series of 50 patients treated using stabilized subcutaneous transposition in an attempt to analyze the postoperative outcomes.

Patients and methods

From 1995 to 2000, 50 patients were treated in our department using stabilized subcutaneous transposition. The patients included 20 females and 30 males, and the average age was 47.9 (range, 13–89) years. The affected side was the right elbow in 24 patients and the left elbow in 26. Average follow-up period was 42.4 (range, 6–81) months. This procedure was applied to treat cubital tunnel syndrome in 19 patients and injuries around the elbow that required an additional procedure to transfer the ulnar nerve in 31 patients.

The causes of cubital tunnel syndrome were osteoarthritis of the elbow joint in 17 patients, valgus deformity of the elbow due to nonunion or malunion of previous fractures in three, compression by ganglion in three, overuse of the elbow due to sports-related or occupation-related activities in three, dislocation of the nerve in two, and osteochondromatosis in one.

Preoperative symptoms in the patients with cubital tunnel syndrome were pain in 11 patients, and all 19 had parasthaesia in the ulnar nerve. Average symptom duration prior to surgery was 35.3 months (range, 2 months to 19 years). Preoperative findings were a positive Tinel sign on the cubital tunnel in 15 patients, motor weakness was observed in 16, and a decreased degree of sensitivity of the ulnar nerve in all. Atrophy of the first interosseus muscle was observed in all patients, atrophy of the other interosseus muscles in 16, and claw-finger deformity was observed in eight. Nerve conduction studies were performed on all patients. Sensory nerve

First presented at the SICOT World Congress 2002, San Diego, California, USA

H. Hashiguchi (✉) · H. Ito · T. Sawaizumi
Department of Orthopaedic Surgery,
Nippon Medical School Second Hospital,
1-396 Kosugicho, 211-8533 Nakahara-ku,
Kawasaki City, Kanagawa, Japan
e-mail: hashi.h@d6.dion.ne.jp
Tel.: +81-44-7335181, Fax: +81-44-7118525

Fig. 1 A 1.5-cm square fascial sling designed on the flexor-pronator muscle fascia

Fig. 2 The nerve transferred anteriorly and stabilized by the sling

conduction velocity was decreased in 11 patients, and this conduction was not evoked in the remaining eight patients. Motor nerve conduction velocity was decreased in 16 patients.

Injuries around the elbow that required stabilized subcutaneous transposition as an additional procedure were fracture of the distal humerus in 21 patients, medial collateral ligament tear in eight, and ulnar nerve injury in two.

The surgical procedure was performed according to Eaton's method. In patients with cubital tunnel syndrome, medial collateral ligament tear, and ulnar nerve injury a curved skin incision about 10 cm long was made posterior to the medial epicondyle of the humerus. In patients with a fracture of the distal humerus, a skin incision was made near the fracture site to facilitate its approach for reduction and internal fixation. The subcutaneous tissue was dissected, and the ulnar nerve was identified. The cubital tunnel was released, and the Osborne ligament and the medial intermuscular septum were split to facilitate nerve transfer without producing tension in the nerve. In some patients with severe or moderate adhesion of the nerve, internal or external neurolysis was also performed. Reduction and internal fixation of the fracture, reconstruction of the medial collateral ligament, or suture of the ulnar nerve was performed on all the patients as an additional procedure. Then, a 1.5-cm-square fascial sling, based on the epicondyle, was applied to the flexor-pronator muscle fascia (Fig. 1). The nerve was moved anterior to the epicondyle, and the sling was sutured to the dermis using nonabsorbable surgical suture (Fig. 2). After carefully ensuring that there was no tension, compression, kinking of the nerve, or bleeding, the skin was closed. Postopera-

tively, in patients with cubital tunnel syndrome, a soft dressing using an elastic bandage was applied, and flexion and extension of the elbow, excluding supination and pronation, were encouraged to the extent of permissible pain in the following days. Supination and pronation of the elbow were permitted after 1 week. Return to all activities, including sports activities that are stressful to the elbow, was permitted after 3 weeks. However, in the case of patients who underwent an additional procedure, the elbow was immobilized with a cast for 2 or 3 weeks. A rehabilitation program was carried out according to the postoperative condition of the injuries around the elbow.

Results

Postoperatively, in all 19 patients with cubital tunnel syndrome, satisfactory results were obtained without disturbance in their daily and sports activities. There were no complications, recurrences, and aggravations of the preoperative symptoms. Instability and slipping back of the nerve to the cubital tunnel were not observed. The preoperative range of elbow motion was not diminished after surgery. Evaluation of the postoperative outcomes revealed that 14 patients had excellent outcomes, that is, motor weakness completely disappeared although slight muscle atrophy and parasthaesia remained; two had good outcomes, that is, slight motor weakness and mild parasthaesia remained; and one had a fair outcome, that is, improvement of the preoperative symptoms, but claw finger deformity remained.

Among 31 patients on whom stabilized subcutaneous transposition was performed as an additional procedure, there was only one patient with transient aggravation of parasthaesia, which eventually recovered. Ulnar nerve palsy and slipping back of the nerve to the cubital tunnel were not observed.

Discussion

Surgical treatments of cubital tunnel syndrome and ulnar nerve transposition involve various procedures including submuscular transposition of the ulnar nerve [8], medial epicondylectomy of the humerus [7], simple decompression of the cubital tunnel [12, 13] and anterior subcutaneous transposition [2]. These procedures were reported to have good postoperative outcomes. However, several problems pertaining to these procedures were reported [3, 5, 9, 10, 11].

Submuscular transposition of the ulnar nerve is a complex procedure and requires extensive dissection of the flexor-pronator muscles and immobilization of the elbow using a cast. In some cases, the nerve may be compressed by scar tissues of the dissected muscles, and preoperative symptoms may recur or aggravate after surgery. Medial epicondylectomy of the humerus also requires dissection of the muscles similar to submuscular transposition.

Simple decompression of the cubital tunnel causes minimal structural damage and does not require immobilization after surgery. However, instability of the nerve may occur due to dissection of the fibrous band. More-

over, this procedure is not recommended for patients with dislocation of the ulnar nerve or severe valgus deformity of the elbow.

Anterior subcutaneous transposition also causes minimal structural damage and does not require immobilization using a cast after surgery. However, slipping back of the ulnar nerve to the cubital tunnel is often observed, and recurrence or aggravation of preoperative symptoms may be induced after surgery.

Stabilized subcutaneous transposition is a simple and reliable procedure that can easily decompress the nerve and prevent the nerve from slipping back to the cubital tunnel without compression. This procedure can also be applied to patients with fractures, dislocations, and medial collateral ligament tears or ulnar nerve injuries. Moreover, this procedure does not influence the postoperative treatment of these injuries, and predictably satisfactory outcomes can be obtained.

However, recent studies reported that subcutaneous transposition had some concerns of the transferred ulnar nerve. Asami reported that the postoperative nerve conduction velocity and clinical results were better in the group with preservation of the extrinsic vessels of the nerve than in the group without [1]. Grewal stated that the transferred ulnar nerve elongated with elbow extension to the same extent as occurred with normal nerve during flexion [6]. Decrease of the blood supply or postoperative elongation of the nerve may delay nerve recovery and induce poor clinical results. Therefore, by following up the patients treated with stabilized subcutaneous transposition and performing the procedure on more patients, we estimated the necessity of preservation of the extrinsic vessels.

On the other hand, several reports concluded that the prognosis of cubital tunnel syndrome is not influenced by the surgical procedure and is greatly dependent on the preoperative stage. Our postoperative results agree with

these reports. Thus, we recommend a simple procedure that involves minimal structural damage—that is, stabilized subcutaneous transposition—for surgical treatment of cubital tunnel syndrome and as a procedure for ulnar nerve transfer.

References

1. Asami A, Morisawa K, Tsuruta T (1998) Functional outcome of anterior transposition of the vascularized ulnar nerve for cubital tunnel syndrome. *J Hand Surg [Br]* 23:613–616
2. Black BT, Barron OA, Townsend PF, Glickel SZ, Eaton RG (2000) Stabilized subcutaneous ulnar nerve transposition with immediate range of motion. *J Bone Joint Surg [Am]* 82:1544–1551
3. Broudy AS, Leffert RD, Smith RJ (1978) Technical problems with ulnar nerve transposition at the elbow. Findings and results of reoperation. *J Hand Surg* 3:85–89
4. Eaton RG, Crowe JF, Parkes JC (1980) Anterior transposition of the ulnar nerve using a non-compressing fasciodelmal sling. *J Bone Joint Surg [Am]* 62:820–825
5. Gelberman RH, Eaton RG, Urbaniak JR (1993) Peripheral nerve compression. *J Bone Joint Surg [Am]* 75:1854–1878
6. Grewal R, Vaitimidis SE, Vardakas DG, Fu FH, Sotereanos DG (2000) Ulnar nerve elongation and excursion in the cubital tunnel after decompression and anterior transposition. *J Hand Surg [Br]* 25:457–460
7. King T, Morgan FP (1959) Late results of removing the medial humeral epicondyle for traumatic ulnar neuritis. *J Bone Joint Surg [Br]* 41:51–55
8. Learmonth JR (1942) A technique for transplanting the ulnar nerve. *Surg Gynec Obstet* 75:792–793
9. Lluch AL (1975) Ulnar nerve entrapment after anterior transposition at elbow. *N Y State J Med* 75:75–76
10. Macnicol M (1979) The results of operation for ulnar neuritis. *J Bone Joint Surg [Br]* 61:159–164
11. Neblett C, Ehni G (1970) Medial epicondylectomy for ulnar palsy. *J Neurosurg* 32:55–62
12. Osborne GV (1957) The surgical treatment of tardy ulnar neuritis. *J Bone Joint Surg [Br]* 39:782
13. Osborne G (1970) Compression neuritis of the ulnar nerve at the elbow. *Hand* 2:10–13