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INCIDENCE OF RE-OPERATION AND SUBJECTIVE OUTCOME FOLLOWING IN SITU DECOMPRESSION OF THE ULNAR NERVE AT THE CUBITAL TUNNEL

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Abstract

The purpose of this investigation was to determine the failure rate of *in situ* decompression for cubital tunnel syndrome as determined by the need for additional surgery. We performed a comprehensive chart review of 56 adult patients who had undergone *in situ* decompression for cubital tunnel syndrome in 69 extremities with more than 1 year follow-up. The patients completed a comprehensive questionnaire concerning preoperative and postoperative pain, numbness, and weakness. After decompression, symptoms were improved substantially or resolved. Five limbs (7%) with persistent symptoms postoperatively were treated successfully with anterior submuscular transposition. These data suggest that *in situ* decompression of the ulnar nerve is a reliable treatment for cubital tunnel syndrome and has a low failure rate. The uncommon patient with continued symptoms after decompression can be treated effectively with transposition of the ulnar nerve.

Keywords

cubital tunnel syndrome; ulnar nerve; decompression; outcome

INTRODUCTION

In situ decompression of the ulnar nerve to treat cubital tunnel syndrome has been proposed by various authors (Adelaar et al., 1984; Chan et al., 1980; Feindel and Stratford, 1958; Foster and Edshage, 1981; Manske et al, 1992; Osborne, 1957) and has been shown to produce results equal to anterior transposition in prospective randomised studies (Bartels et al, 2005; Biggs and Curtis, 2006; Gervasio et al., 2005) The advantages of *in situ* decompression include shorter incision with less surgical dissection, avoidance of ulnar nerve devascularisation, and faster rehabilitation and recovery. Moreover, subsequent anterior transposition can relieve symptoms if the simple decompression fails (Bainbridge, 2004; Bartels et al., 2005; Manske et al, 1992). However, there is little information on the incidence of failure of simple decompression necessitating anterior transposition of the ulnar nerve or on the outcome of transposition. We report the incidence of failed *in situ* decompression and the results of subsequent anterior transposition, and examine the influence of patient age, duration of symptoms, and severity of preoperative symptoms on the results of *in situ* decompression.

PATIENTS AND METHODS

We performed a comprehensive chart review of all adult patients (>18 years old) who had undergone *in situ* decompression for cubital tunnel syndrome between 1996 and 2006 as previously described (Bartels et al., 2005; Biggs and Curtis, 2006; Dellon, 1989; Gervasio et al, 2005; Manske et al, 1992) with a minimum 1 year follow-up. Indications for *in situ* decompression included symptoms of medial elbow, forearm, and/or hand pain or paraesthesiae in the small finger, along with one or more of the following signs: elevated two-point discrimination in the small finger, intrinsic muscle weakness, or a positive flexion/compression test at the cubital tunnel (Novak et al, 1994). Patients with medial epicondylitis, elbow arthritis, or ulnar nerve subluxation were excluded. Eighty-seven patients met the criteria above.

We attempted to contact all patients by mail or telephone using the most recent information in the medical chart, along with a search of the Internet. Thirty patients could not be located and one declined to participate in the study. Fifty patients were successfully contacted by telephone and six by mail; of the 56 total patients, 13 had bilateral decompression, making a total of 69 procedures.

The average patient age was 52 years, ranging from 20 to 80 years; 22 patients had a left cubital tunnel syndrome, 21 patients a right cubital tunnel syndrome, and 13 patients had bilateral involvement. Follow-up averaged 49 months (range 13 to 94 months). Most commonly, preoperative symptoms were present for more than 1 year but ranged from 3 months to greater than 24 months. The duration of symptoms prior to decompression varied; 21 patients (30%) had symptoms for more than 2 years, 17 (25%) had symptoms for 12–24 months, 16 (24%) had symptoms for 6–12 months, 10 (15%) had symptoms for 3–6 months, 3 (4%) had symptoms for less than 3 months and symptom duration prior to surgery was unknown in two patients.

Abnormal sensation was the most common preoperative symptom and was found in 65 (94%) of the extremities, hand pain was noted in 53 (77%) extremities, elbow/forearm pain was noted in 50 (73%) extremities, and weakness was reported in only 46 (67%) extremities. Preoperative nerve conduction studies were performed in 66 of the 69 cases and were available for review in 63 of the cases. Fifty patients (79%) had abnormal nerve conduction findings consistent with cubital tunnel syndrome; 13 (21%) had negative or equivocal findings, but met the previously noted criteria for surgery and were considered surgical candidates according to Tomaino et al (2001). A preoperative Dellon severity score (Dellon, 1989) was assigned for all elbows based on preoperative history and physical examination information recorded in the chart. A Dellon score of 'mild' was assigned to 49 limbs with reported abnormal sensation and/or subjective weakness without objective physical exam finding. A score of 'moderate' was given to 12 limbs with measurable weakness in pinch or grip strength. A score of 'severe' was given to the eight patients with intrinsic muscle atrophy.

Surgical procedure

Under general or regional anesthesia in the supine position with the affected limb on an arm table, a 5 cm incision is centered at the medial epicondyle. The medial cutaneous nerves of arm and forearm are protected in the exposure of the cubital tunnel retinaculum. The cubital tunnel retinaculum (ie., arcuate ligament, Osborne fascia) is then divided to expose the ulnar nerve. Distally, the fascia of the flexor carpi ulnaris muscle is divided and the muscle bluntly spread to decompress the ulnar nerve. Deeper fascia is divided overlying the nerve into the forearm. Proximal dissection was carried out as necessary to fully decompress the nerve but was limited to avoid subluxation. The medial intermuscular septum is not routinely excised.

Circumferential dissection of the nerve was avoided to prevent devascularisation or destabilisation. Once the decompression is complete, the elbow was passed through its full arc of motion to assure that the nerve remained stable behind the medial epicondyle. It was not necessary to perform an anterior transposition for instability of the ulnar nerve in any of these patients. A bulky soft dressing or posterior splint was applied for 1 week and patients were then allowed unrestricted range of motion and activities as tolerated, avoiding heavy activity for 4 weeks with the operated limb.

Post-surgical evaluation

All patients completed a questionnaire inquiring if they had any subsequent surgical procedures for treatment of persistent cubital tunnel syndrome symptoms. The questionnaire also evaluated preoperative compared to postoperative elbow/forearm pain, hand pain, abnormal sensation, and weakness. Postoperative evaluation options included: 'none', 'improved but still present', 'same as before surgery', and 'worse than before surgery'. Data obtained during clinic visits were not included as a part of this investigation.

Analysis of data

Data analysis was performed using the SPSS statistical software (version 15.0 1, SPSS, Inc., Chicago, IL). A Wilcoxon signed rank test was used to assess for change from immediate postoperative status to final follow-up status. Spearman's correlations were used to determine the effect of age and preoperative symptom duration on outcome. A Fisher's exact test was used to compare preoperative Dellon classifications with postoperative outcome. Significance was set at $\alpha = 0.05$.

RESULTS

Subsequent operative treatment for cubital tunnel syndrome

Five patients (7%) had persistence of the preoperative symptoms and failed to improve after *in situ* decompression. Anterior submuscular transposition of the ulnar nerve was performed in each case. Prior to the transposition procedure, all five patients complained of persistent elbow/forearm pain, hand pain, abnormal sensation, and weakness similar to what had been present prior to the cubital tunnel decompression. These five patients had preoperative Dellon scores of mild (three cases) or moderate (two cases). At surgery, the nerve was not encased in scar tissue but passed freely posterior to the medial epicondyle; the anterior transposition procedure was not impaired by the previous decompression procedure. All patients showed improvement in symptoms after transposition. Three patients had partial or complete resolution of elbow/forearm pain, four patients had complete resolution of hand pain, and all five patients had improvement or complete resolution of abnormal sensation and weakness.

Elbow/forearm pain

Forty-seven of the 50 cases (94%) with preoperative elbow or forearm pain reported no pain or an improvement in symptoms immediately after surgery, and 43 (86%) reported improvement or no pain at final follow-up. Only three (6%) reported no change or increased pain immediately postoperatively, which increased to 7 (14%) at final evaluation (Table 1).

Hand pain

An improvement in the level of pain in the immediate postoperative period was reported in 48 (91%) of the 53 cases with preoperative hand pain, while 45 (85%) reported improvement at final follow-up. Only 5 (10%) reported no change or increased pain immediately postoperative, which rose to 8 (15%) at final evaluation (Table 1).

Abnormal sensation

Immediate postoperative improvement in sensation was reported in 56 (89%) of the 65 cases with abnormal sensation preoperatively, and improvement at final follow-up was reported in 53 (82%). Only 9 (14%) reported no changes or increased symptoms immediately after surgery, increasing to 12 (18%) at final follow-up (Table 1)

Weakness

Of the 46 cases with preoperative weakness, 39 (85%) had immediate postoperative improvement that continued to final follow-up. Only 7 (15%) reported no change or increased weakness immediately after surgery and at final follow-up (Table 1).

A Fisher's exact test showed that the preoperative Dellon score was not significantly associated with resolution of postoperative elbow or forearm pain, hand pain, or abnormal sensation. Additionally, a more severe Dellon score was not associated with a worse outcome. Subjects with a preoperative Dellon score of moderate or severe were as likely to have improvement in their symptoms after surgery as were subjects with a mild Dellon score.

A Spearman's correlation showed that patient age (range 20 to 80 years) and the duration of symptoms (range 3 months to more than 24 months) prior to surgery had no effect on postoperative symptoms. Furthermore, the Wilcoxon signed rank test showed that results did not decline over time; there was no significant change in symptoms from immediately after surgery until the time of final follow-up.

DISCUSSION

Our results indicate that *in situ* decompression is reliable in relieving patient symptoms related to compression of the ulnar nerve at the elbow. Only 7% of the limbs required subsequent anterior transposition of the ulnar nerve for persistent or worsening symptoms; all noted improvement following the additional surgery. The concept that failed *in situ* decompression could be treated by anterior transposition has been proposed by Manske et al (1992) and Bainbridge (2004). Bartels et al. (2005) reported that six of 75 *in situ* decompression patients failed the initial decompression procedure and had subsequent surgery, but the specific procedure was not identified. Of interest, four of the six patients had fibrosis about the ulnar nerve at the time of re-operation. We did not note any substantial fibrosis at the time of submuscular transposition, as hypothetically suggested by Mackinnon and Novak (2005), perhaps due to our encouragement of early elbow range of motion.

Approximately 90% of the patients experienced complete or partial relief of pain in the elbow, forearm, and hand as a result of *in situ* decompression; nearly as many noted similar improvement in the abnormal sensation and perception of hand weakness. These results are comparable to the best reports of anterior transposition of the ulnar nerve (Bartels et al, 2005; Biggs and Curtis, 2006; Gervasio and Gambardella, 2004). Gervasio and Gambardella (2004) in a prospective, randomised trial of patients with Dellon grade 3 cubital tunnel syndrome found similar success rates between *in situ* decompression and anterior transposition. Excellent results were reported in 54% of the decompression subjects and 51% of the transposition subjects while good results were reported in another 26% and 31% of subjects respectively (Gervasio et al., 2005). Bartels et al. (2005) found lower success rates overall with 65% having a good to excellent outcome with decompression and 70% with anterior transposition; however, complication rates were significantly lower with decompression, 9.6% vs. 31%. Likewise, Biggs and Curtis (2006) found comparable clinical results between the groups; 61% of the decompression subjects and 67% of the transposition subjects demonstrated an improved clinical grade after surgery. There were no

complications in the decompression group compared to 14% in the transposition group. There have been two recent meta-analyses comparing decompression and transposition. The first evaluated four randomised controlled investigations of simple decompression compared to anterior transposition and concluded that in patients without prior surgery or injury to the elbow, there was no significant difference in clinical outcomes or postoperative nerve conduction tests between the treatment groups. They favoured, therefore, the decompression procedure because of its simplicity and faster recovery (Zlowodzki et al., 2007). The other investigation (Macadam et al., 2008) evaluated ten comparative studies of decompression and transposition. It found no significant difference between the groups but it did demonstrate a trend in the odds ratio of improvement favoring transposition (either subcutaneous or submuscular).

The simplicity of *in situ* decompression suggests that it be considered a first-line intervention for cubital tunnel syndrome except in cases of a subluxating nerve, cubitus valgus, or abnormal cubital tunnel floor as may be found in osteoarthritis. In the uncommon case when *in situ* decompression is not effective, anterior transposition can be subsequently performed with good results. There is no concern for devascularisation of the ulnar nerve in the decompression procedure, in contrast to transient ischemia of the ulnar nerve with anterior transposition (Ogata et al., 1985). Finally, the minimal surgical dissection minimises operative discomfort and allows patients to regain elbow motion and forearm function more quickly. In the rare cases of failure of the decompression procedure, we prefer a submuscular transposition as the most reliable technique in such a revision situation; subcutaneous transposition should also provide improvement.

Severity of nerve compression (Bartels et al., 1998, 2005; Biggs and Curtis, 2006; Dellon, 1989; Ferlic, 1991) and the duration of symptoms prior to surgery (Bartels et al., 2005; Chan et al., 1980; Ferlic, 1991) have been cited as factors affecting the outcome of decompression. Our results agree with those of Bartels et al (2005) in showing no association between subjective clinical outcome and the Dellon score for preoperative compression severity. However, other studies have suggested that anterior transposition is a more appropriate treatment in patients with severe preoperative symptoms (Catalano and Barron, 2007; Pasque and Rayan, 1995; Williams and Dellon, 2007).

The preoperative duration of symptoms, which varied widely among our patients, did not affect the subjective clinical outcome. Bartels et al. (2005) reported that symptom duration did not affect outcome, but Chan et al (1980) found less improvement in cases with more than 1 year of preoperative symptoms.

The strengths of this study include the mean follow-up of 4 years and a high participation rate in those patients able to be contacted. The limitations include an inability to contact all patients and the fact that this is a retrospective study with potential recall bias. Additionally, the majority of the patients included had mild preoperative nerve compression.

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Table 1

Preoperative and postoperative symptom status

Symptom	Presence of symptom before surgery N (%) [*]	Status of symptom after surgery N (%) [†]			
		None	Still present but improved	Same as before surgery	Worse than before surgery
Elbow/Forearm Pain	50/69 (73)				
Immediately postoperative		25/50 (50)	22/50 (44)	2/50 (4)	1/50 (2)
Current		29/50 (58)	14/50 (28)	4/50 (8)	3/50 (6)
Hand Pain	53/69 (77)				
Immediately postoperative		27/53 (51)	21/53 (40)	4/53 (8)	1/53 (2)
Current		29/53 (55)	16/53 (30)	5/53 (9)	3/53 (6)
Abnormal Sensation	65/69 (94)				
Immediately postoperative		32/65 (49)	24/65 (40)	8/65 (12)	1/65 (2)
Current		33/65 (51)	20/65 (31)	8/65 (12)	4/65 (6)
Weakness	46/69 (67)				
Immediately postoperative		18/46 (39)	21/46 (46)	6/46 (13)	1/46 (2)
Current		18/46 (39)	21/46 (46)	2/46 (4)	5/46 (11)

^{*} All 69 subjects in study[†] Totals in each category based on number of cases with reported preoperative symptom.