Anterior submuscular transposition of the ulnar nerve

FOR POST-OPERATIVE FOCAL NEUROPATHY AT THE ELBOW

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Outcome studies of revision surgical treatment for recurrent or persistent neuropathy of the ulnar nerve at the elbow are relatively rare and none involves patient self-assessment. In this study of 40 patients (41 elbows), a clear discrepancy is shown between clinical assessment and the patient's own view. From clinical assessment, 20% of patients had an excellent result, whereas only one (2.5%) patient self-reported a complete cure. More reports using patient self-assessment and validated scores are required.

Compression of the ulnar nerve at the elbow is the second most frequent form of nerve compression in the arm after carpal tunnel syndrome. A number of surgical treatments have been reported,^{1,2} but the results for recurrent or persistent symptoms after surgery for ulnar nerve compression have been infrequently discussed.³⁻¹⁴

We have reviewed the outcome of re-exploration of the ulnar nerve combined with anterior submuscular transposition in patients with persistent symptoms, using a patient self-assessment questionnaire.

Patients and Methods

A retrospective review was performed of 40 patients (41 elbows) who had undergone a submuscular anterior transposition between November 1997 and November 2002 for recurrent or persistent ulnar neuropathy at the elbow after previous surgery.

There were 15 (37.5%) men and 25 (62.5%) women. The mean age of the men was 49.5 years (29.3 to 70.2) and the women was 50.1 years (24.6 to 75.4). In 34 (85%) the right hand was dominant, in five (12.5%) the left, and one (2.5%) patient was ambidextrous. The left side was affected in 20 patients (50.0%), the right side in 19 (47.5%) and one patient (2.5%) had both sides involved. In 21 (51.2%) patients, the affected arm was the dominant side.

Before revision surgery, decompression alone had been undertaken on 20 elbows (48.8%), an anterior subcutaneous transposition on 12 (29.3%), a decompression and anterior subcutaneous transposition on three (7.2%), a medial epicondylectomy on four

(9.8%), and an external neurolysis after an unsuccessful anterior subcutaneous transposition on two (4.9%).

Pre-operatively, all patients had the signs and symptoms of ulnar nerve compression at the elbow. Thirty-nine (97.5%) complained of tingling in the fourth and fifth fingers. There was diminished sensation over the ulnar part of the fourth and the fifth fingers in 38 (95%) patients, diminished pinprick perception in 19 (47.5%) and weakness of the intrinsic muscles in 24 (60%). Three patients had a loss of muscle power to MRC grade 3. Four patients had atrophy of the small muscles of the hand. Compression of the ulnar nerve at the elbow was confirmed by neurophysiological examination in all patients and two had symptoms of axonal degeneration. All patients underwent an external neurolysis of the ulnar nerve and anterior submuscular transposition as described by Dellon.¹⁵ However, an epineurectomy of the ulnar nerve and lengthening of the origin of pronator teres was not performed. Post-operatively, a posterior splint with the elbow flexed at 90°, the forearm in slight pronation, and the wrist in neutral position, was retained for three weeks before mobilisation. Patients were assessed both clinically and by a self-assessment questionnaire.

The mean clinical follow-up was 11.4 ± 10.7 months (2.5 to 50.1) after surgery. Thereafter, two patients were lost to follow-up, of whom one had died and the other could not be traced. Thirty-eight patients were therefore available for self-assessment by telephone survey at a mean follow-up of 2.4 ± 1.5 years (0.5 to 5.5).

The telephone survey was undertaken using a standard form which assessed the patients'

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Table I. Findings at revision surgery (in some cases more than one finding was reported)

Finding	Number
Dense fibrotic tissue tethering the ulnar nerve at the:	
Entrance to flexor carpi ulnaris	6
Proximal part cubital tunnel	4
Medial epicondyle	5
Other locations or diffuse	12
Pseudoneuroma	4
Flattening of the nerve	4
Subluxation of the nerve	1
Intact medial intermuscular septum (previous anterior subcutaneous transposition)	1
Kinking of the ulnar nerve	2
Previous incision anterior to the medial epicondyle	1
No abnormality found at surgery	9

perception of outcome, pain, numbness, tingling, cold intolerance, strength, and employment problems before and after surgery. The questionnaire was a modification of that used by Novak, Mackinnon and Stuebe¹⁶ and was translated into Dutch. Statistical analysis was with the chi-squared test. P values less than 0.05 were regarded as significant.

Results

The findings at operation are shown in Table I. Post-operatively one patient developed a deep wound infection that necessitated drainage. All patients regained normal elbow function.

Clinical. At clinical follow-up, 16 patients (40%) still complained of tingling in the fourth and fifth fingers. Diminished sensation was present in 26 patients (65.0%) diminished pinprick perception in six (15.0%) and motor weakness in ten (25.0%). Eight patients (20%) were free of signs and symptoms at final follow-up. One patient was worse, having developed numbness of the fourth and fifth fingers after surgery with persistent pain. Two patients with signs of axonal degeneration did not improve.

Patient self-assessment. According to the patients, 16 (42%) of the procedures improved their condition, 15 (39.5%) had affected no change and seven (18.5%) had made them worse. Of the seven patients who were worse, only one was identified from clinical assessment. Of the remaining six, three were identified clinically as unchanged and three as improved. One had an excellent clinician-based assessment. Two patients who had reported an

Table II. Number of patients with symptoms, pre- and post-operatively

	Pre-operatively (%)	Post-operatively (%)
Pain in digits 4 and 5	22 (53.7)	13 (31.7)
Tingling in digits 4 and 5	34 (82.9)	24 (58.5)
Numbness in digits 4 and 5	34 (82.9)	25 (61.0)
Cold intolerance in digits 4 and 5	22 (53.7)	19 (46.3)
Pain at the elbow	28 (68.3)	23 (56.1)

not reported any change were regarded as being clinically improved.

For 23 patients the time between the previous operation and the submuscular transposition was known. For those with a subjectively better result this was 24.8 ± 26.0 months ($n = 11$). For those without any change the time interval was 9.2 ± 3.7 months ($n = 8$) and for those who were worse it was 10.9 ± 10.8 months ($n = 4$).

All those who reported an improvement would, given the same circumstances, have chosen surgery again, as would eight of those who did not notice any difference and even three of the patients who felt they were worse. Only the reductions in pain, tingling and numbness were statistically significant ($p < 0.05$, $p < 0.01$ and $p < 0.02$; respectively, Tables II and III).

Eight patients had recurrent rather than persistent symptoms. They had been free of symptoms for 31.9 ± 40.1 months (6 to 120). The remaining 30 patients (including the patient with bilateral procedures) had persistent complaints. Patients with recurrent symptoms tended to have better results although this was not statistically significant (Table IV). Twelve patients judged that their sensation was normal, 18 that it was improved, 15 unchanged and, five felt that it had become worse after surgery.

Strength was normal in only seven patients. Twelve patients reported improvement, 19 patients reported no change and seven noted a deterioration in strength. Twenty-seven patients felt that the loss of strength was due to their ulnar nerve problem, three reported that it was the result of both the ulnar nerve problem and another problem, and one was uncertain.

The mean score for post-operative pain in the fourth and fifth fingers was 5.8 ± 9.7 (0 to 60), compared with a pre-operative score of ten. The mean score for post-operative pain at the elbow was 4.7 ± 3.6 (0 to 10). None of the patients used medication for pain. Assessment of the rela-

Table III. Relationship between pre-operative status and post-operative symptoms

Pre-operative status	Symptoms present		Symptoms not present	
Post-operative symptoms	Present	Not present	Present	Not present
Pain in digits 4 and 5	12	10	1	15
Tingling in digits 4 and 5	24	10	0	4
Numbness in digits 4 and 5	23	11	2	2
Cold intolerance in digits 4 and 5	17	5	2	14
Pain at the elbow	19	9	4	6

Table IV. Relationship between recurrence or persistence of symptoms and subjective judgement of outcome. Number of arms (mean pain score $\pm$ SD)

	Subjective judgement			
	Better	Unchanged	Worse	Unknown
Recurrence	5 (1.8 $\pm$ 1.8)	2 (2.5 $\pm$ 3.5)	0	1
Persistence	11 (2.7 $\pm$ 2.7)	13 (9.1 $\pm$ 15.7)	7 (8.4 $\pm$ 1.9)	2

tionship between the absence of pain and the patient's judgement of sensation and strength revealed that only five patients were free of pain in the fingers and elbow and only one felt sensibility and strength was normal. Consequently, only one patient had an excellent result (Table V).

Pre-operatively, six patients were retired. Thirteen patients (37%) were not working due to their ulnar nerve symptoms and had been absent from work for a mean of 40.6 ± 20.4 weeks (6 to 78) before surgery. By a mean of 26.3 ± 36.0 weeks (3 to 130) after transposition, all had returned to work although only seven returned to full working activities. Patients who did not work pre-operatively started to work after a mean of 44.5 ± 45.4 weeks (8 to 130) whereas the other patients returned to work after a mean of 12.6 ± 18.8 weeks. Six patients changed their working activities due to their symptoms. Two of them took up less strenuous work, one reduced to part-time employment, and the remaining three patients (18.5%) were regarded as permanently disabled.

Discussion

Focal ulnar neuropathy at the elbow can be treated surgically in a number of ways: simple decompression, anterior transposition (either subcutaneous, intramuscular or submuscular) and medial epicondylectomy.^{1,2,17} The prevalence of persistent symptoms varies between 9.9% and 21% with 0.7% to 4.5% being exacerbated by surgery.² The number of recurrences is not known.⁴

Few reports deal specifically with recurrent or persistent signs and symptoms after surgery.³⁻¹⁴ Revision techniques which have been described include external neurolysis,⁸ decompression,⁸ anterior subcutaneous transposition,^{7,8} anterior submuscular transposition,^{4,5,10,11} repositioning of the nerve,⁸ wrapping with a Silastic strip,⁶ and wrapping with autogenous saphenous vein.^{12,13} Simple decompression is the simplest and least invasive procedure, whereas anterior submuscular transposition is the most extensive. Our policy for primary surgery has been to decompress the

ulnar nerve or to transpose it subcutaneously. For recurrent or persistent ulnar palsy we have performed anterior submuscular transposition.

Most reports describe their results as either "excellent", "good", "fair" or "poor". Apart from the qualification "excellent" (completely free of symptoms and signs), the others are not precisely defined or validated and statistical analysis is not possible.³ More sophisticated grading systems have been developed^{3,18,19} but these clinician-based scores may not always reflect patients perceptions. In this study we assessed outcome with both a clinical score and a patient-based questionnaire.

As with earlier studies women outnumbered men.⁸ This is in contrast to primary ulnar nerve compression and the explanation is unclear.² The other demographics are within the ranges of primary ulnar nerve compression.²

In the Netherlands, the majority of neurosurgeons perform either simple decompression or anterior subcutaneous transposition. Medial epicondylectomy is seldom performed.

Compression can occur at several levels along the course of the ulnar nerve. We have never found an Arcade of Struthers and other recent studies have suggested that it does not exist.^{20,21} Most frequently, the nerve was tethered in fibrotic tissue somewhere along its course. In only one case was an intact medial intermuscular septum found to be causing compression of the nerve.

The overall results of the patient-based assessment were not good. Only one patient (2.7%) was free of symptoms and had, therefore, an excellent result. This is in contrast to the results of our clinical assessment in which 20% were excellent. The reported proportion of excellent results varies between 0% and 37.5%^{4-7,10-12} with the majority being less than 5%.

The assessment "poor" is generally used to classify patients who become worse or remain unchanged. In our study, 58% of the patients were classified as poor. This is higher than other studies have reported.^{4-7,10-12} However, these studies report clinician-based assessments and compare with our findings of 2.5% poor outcome when using a similar methodology.

More than 40% of the patients improved. All would have opted for surgery again. The majority of those who did not improve would also have been prepared to undergo surgery again. More remarkable perhaps is that over 40% of the patients who became worse were of the same opinion.

Table V. Relationship between absence of pain and subjective judgement of sensibility and strength

	No pain in fingers 4 and 5*				No pain in elbow*				No pain in fingers 4 and 5, and elbow*			
Sensibility	N	N	A	A	N	N	A	A	N	N	A	A
Strength	N	A	N	A	N	A	N	A	N	A	N	A
Number of patients	2	3	1	4	2	3	1	0	1	3	1	0

* N = normal, A = abnormal

For the whole group, we achieved a significant improvement in pain, numbness and tingling in the fourth and fifth fingers. Pain at the elbow is usually caused by subcutaneous sensory neuroma formation and is unlikely to improve after revision surgery,

Although statistical significance was not reached, two factors seem to offer a positive outcome. Firstly, recurring rather than persistent symptoms and, secondly, a longer period between revision surgery and the initial operation.

Strictly speaking, only one complication occurred (2.4%). However, if the development of symptoms which previously did not exist is also considered as a complication, then this number is much higher. As eight patients reported new symptoms (pain in the fourth and fifth fingers, numbness, cold intolerance, or pain at the elbow), then 21% had complications and 10% had new pain at the elbow. Earlier reports do not provide exact figures about complications after revision surgery.

This study clearly demonstrates a discrepancy between clinical assessment and patient self-assessment. Assessment of outcome by the patient is recognised to be the most reliable method. Patients are less interested in, for example, a change of strength by one MRC grade or of improvement in two-point discrimination by 2 mm. They want to know how many patients found themselves improved or cured or how many were satisfied, especially after revision surgery. Further work, with patient self-reported outcomes, is clearly required with the development of a validated patient self-assessment score.

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