Acta Neurochir (Wien) (1991) 110: 44–48

Acta Neurochirurgica

Posttraumatic Ulnar Neuropathy versus Non-traumatic Cubital Tunnel Syndrome: Clinical Features and Response to Surgery

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Summary

The outcome of 53 patients operated on either for posttraumatic ulnar neuropathy (PUN) or non-traumatic cubital tunnel syndrome (CTS) was reviewed after 3 years follow-up. Results were analyzed and compared considering the surgical technique used (neurolysis versus anterior transposition or combined) and a variety of clinical features that could influence outcome after nerve release. In the whole series, excellent outcome was obtained in 39 patients (73%). No major differences were found with the different surgical procedures. Slightly better results, but no statistically significant, were found in cases with CTS. As to clinical parameters, patients with CTS had a higher mean age, a shorter duration of symptoms and most were men. The presence of symptoms for more than one year before operation significantly diminished the chance of satisfactory recovery in cases with CTS, but not in those with PUN. For both CTS- and PUN-cases with symptoms for more than one year, neurolysis plus anterior transposition was the more useful technique. Our study shows that CTS and PUN differ to a certain extent in their clinical profile, electrophysiological findings and response to different surgical approaches and hence can be considered as two different clinical entities.

Keywords: Ulnar entrapment neuropathy; ulnar nerve compression; cubital tunnel syndrome; traumatic; non-traumatic; neurolysis; anterior transposition; results.

Introduction

Nerve compression at the elbow region represents the most frequent entrapment neuropathy of the ulnar nerve [14, 18, 20]. Concerning aetiology, a wide spectrum of pathological conditions has been identified at this level but, in most cases, one of two different clinical entities can be recognized, namely posttraumatic ulnar neuropathy (PUN) or non-traumatic cubital tunnel syndrome (CTS). In the former, also known as tardy ulnar nerve palsy, nerve compression is caused by a decreased size of the canal related to a progressive or residual cubitus valgus deformity following supracondylar humeral fractures. Nerve lesion in non-traumatic CTS is due to nerve impingement either by the aponeurotic bands within the fibro-osseous canal behind the medial epicondyle or by the fibrous arch bridging the two heads of the flexor carpi ulnaris (Osborne's lesion) [4], or by subluxations of the nerve during elbow flexion.

Surgical procedures, simple decompression [10, 19, 22], anterior transposition [1, 7, 12], medial epicondylectomy [6, 8, 13] or combination of these techniques have been advocated for many years, all of them providing satisfactory results. However, studies comparing the benefits of different surgical techniques do not differentiate the type of ulnar neuropathy involved [2, 5, 8, 11].

Based on our 15-year surgical experience treating ulnar neuropathies at the elbow, the purpose of this study is to analyze retrospectively if PUN and CTS differ as for clinical features and response to surgery.

Patients and Methods

From January 1970 to December 1985, 150 patients with ulnar nerve lesions of varied aetiology including both compressive lesions and nerve lacerations or clear-cut sections due to acute trauma were treated in our department (Table 1). Of the total, 62 (41%) were operated on with the clinical diagnosis of ulnar entrapment neuropathy. Nerve compression was located at the elbow in 56 patients and at the Guyon's canal in 6.

Table 1. *Aetiology of Ulnar Nerve Lesions in a 15-year Survey*

Treated by surgery		127
Lacerations and clean-cut lesions	51	
Entrapment neuropathies	62	
Posttraumatic acute compressions	8	
Iatrogenic lesions	6	
Conservative treatment		23
Total		150

Table 2. *Surgical Techniques Performed in Relation to the Type of Ulnar Neuropathy*

Lesion	n	NL + TP	TP	NL
PUN	34	19	9	6
CTS	19	13	5	1
Total	53	32	14	7

NL: Neurolysis, TP: Anterior Transposition.

Among patients with ulnar nerve neuropathy at the elbow, 34 had a previous elbow fracture and therefore were diagnosed as PUN. The average latent period between the injury and the onset of neuropathy was 15.5 years in these cases (range: 3–27). CTS without previous trauma or other precipitating factor or associated condition was diagnosed in 19 patients. In 4 of them, a clear nerve compression by the aponeurotic arc of the flexor carpi ulnaris could be detected. A ganglion at the cubital tunnel was the compressive factor in 3 other patients and therefore they were excluded from this study. No cases of subluxation of the ulnar nerve caused by a shallow canal were encountered in this series.

Only the 53 patients with PUN or CTS have been compared in this study. There were 37 men and 16 women with a mean age of 42 years, ranging from 12 to 70. Preoperative electromyography (EMG) of muscles dependent on the ulnar nerve and motor and sensory nerve conduction studies were performed in all patients using standard techniques [3, 15]. As a routine in our practice, only cases revealing pathologic findings in the electrophysiological studies were subjected to surgical treatment.

Surgical treatment involved aponeurotic release by splitting Osborne's arcade followed by external neurolysis, anterior transposition or combination of both procedures, depending on the macroscopic findings at the time of surgery. Thus, when the nerve trunk showed intense fibrotic reaction or there was an evident tension of the nerve in the postcondylar groove, anterior transposition with exoneurolysis was performed. Aponeurotic release as a simple technique was reserved for cases with short duration of symptoms and macroscopically normal nerve anatomy. Table 2 summarises the different techniques used in relation to the type of lesion. The postoperative follow-up ranged from 2 to 8 years, mean 3.

Before surgery and during the follow-up, motor disability and sensory disturbances were clinically assessed according to the scoring system proposed by the Nerve Committee of the British Medical Research Council [17]. The outcome was graded as follows: "excellent" if there was complete motor and sensory recovery (M5-S4), "good" if nerve function recovered M4 and S3+ levels, "fair" if no more than M3 or S3 recovery levels were regained and "unchanged" if there was no improvement in the motor or sensory function. Both "excellent" and "good" outcome were considered as satisfactory results.

Results

The outcome of patients with CTS and with PUN are summarised in Table 3. There was a statistically significant greater number of patients with complete recovery (excellent outcome) among CTS than PUN patients ($p < 0.05$). When patients with satisfactory outcome were considered, no significant differences were found, but still slightly better results were obtained in cases with CTS (79%) than in cases with PUN (70%).

Table 3. *Outcome of Patients with Posttraumatic Ulnar Neuropathy (PUN) and with Non-Traumatic Cubital Tunnel Syndrome (CTS)*

Outcome	PUN	CTS
Excellent	8 (23%)	9 (47%)
Good	16 (47%)	6 (32%)
Fair	5 (15%)	3 (16%)
Unchanged	5 (15%)	1 (5%)

Table 4. *Satisfactory Outcome of PUN and CTS Patients in Relation to the Surgical Technique*

Technique	PUN[a]	CTS[a]	All patients[a]
NL + TP	13/19	11/13	24/32 (75%)
TP	7/9	3/5	10/14 (71%)
NL	4/6	1/1	5/7 (71%)
Total	24/34	15/19	39/53 (73%)

[a]: Ratio satisfactory outcome/total operated patients.
NL: Neurolysis, TP: Anterior Transposition.

As for surgical technique, similar results were found with the three surgical procedures. Neurolysis in combination with anterior transposition gave a greater chance of total recovery in patients with CTS (85% satisfactory results vs 68% for PUN patients) (Table 4). Considering all 53 lesions together, satisfactory outcome was obtained in 39 patients (73%). Only 6 cases (12%), 5 PUN and 1 CTS, remained unchanged after surgery. These 6 cases fall into the older age group of patients (mean 50 years) with a long history of symptoms (mean 49 months) and marked functional deficits.

As for the clinical profile, some differences were found between patients with CTS and those with PUN. Patients with non-traumatic cubital tunnel syndrome had a higher mean age (48 ± 16 years vs 39 ± 12 for PUN, $p < 0.01$), a shorter duration of symptoms (14 ± 8 months vs 24 ± 10, $p < 0.005$) and most patients were men (ratio men/women 17/2 vs 20/14, $p < 0.05$). Patient age did not influence outcome after surgery, but all patients less than 35 years-old in the CTS-group achieved excellent results.

In the preoperative clinical assessment, patients with CTS had a more severe sensory deficit than motor. Out of 40 patients in the whole series with motor disability prior to surgery, only 10 recovered normal function.

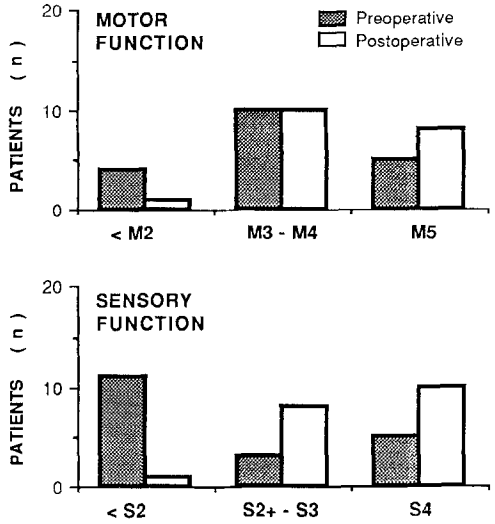

Fig. 1. Pre- and postoperative motor and sensory functional assessment in patients with non-traumatic cubital tunnel syndrome, using the scoring system proposed by the Nerve Committee of the British Medical Research Council

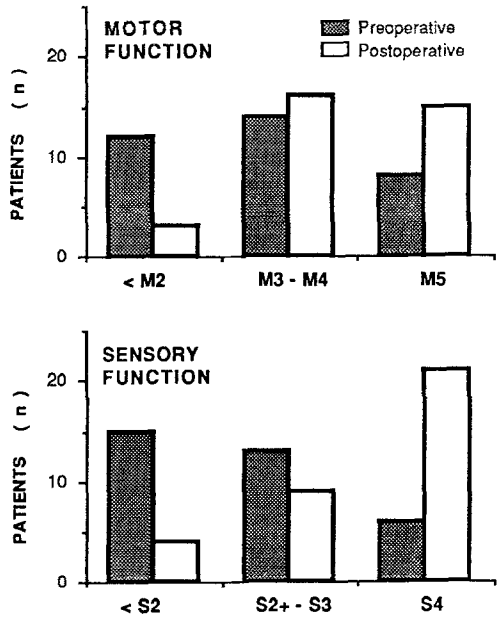

Fig. 2. Pre- and postoperative motor and sensory functional assessment in patients with posttraumatic ulnar neuropathy

As to the sensory deficit, 20 of 42 with initial impairment regained full function. However, patients with PUN recovered complete sensory and motor function after surgery more promptly than those with CTS (Figs. 1 and 2).

Table 5 displays the electrodiagnostic studies. Denervation signs of the ulnar-innervated muscles were detected by EMG in 28 of the 34 patients with PUN (82%) and 12 of the 19 with CTS (63%). Abnormal conduction velocities of the ulnar nerve across the elbow were encountered in all cases. Sensory conduction was less affected than motor in PUN cases. There were statistically significant differences between PUN and CTS patients with regard to the ability to recover normal motor conduction velocity. Patients with PUN did not regain normal mean values after treatment. Furthermore, the preoperative time interval of motor latency at the elbow was significantly higher in PUN than CTS cases.

When outcome was related to the duration of symptoms, patients with CTS recovered easily complete nerve function if they were operated upon within 1 year of the onset of symptoms (Table 6). This difference was statistically significant ($p < 0.05$). No differences in therapeutic benefit could be demonstrated for patients with PUN treated more or less than 1 year from onset of symptoms.

Comparing the three surgical techniques in the whole series, the percentage of excellent results in relation to the duration of symptoms disclosed that for lesions with more than 12 months duration of symptoms, neurolysis plus anterior transposition was the more useful technique (Fig. 3). Instead, 8 of the 11 patients operated on by neurolysis within the first 6 months of symptomatology achieved excellent results. All these patients showed less fibrotic damage at the time of surgery.

Discussion

This review shows that satisfactory results can be obtained in the treatment of ulnar entrapment neuropathies by using neurolysis, anterior transposition or a combination of both surgical techniques when they are properly performed with correct indications. Furthermore, based on differences in some clinical parameters, electrophysiological findings and the response to surgery, this retrospective study confirms that CTS and PUN can be considered as two different clinical entities.

It has already been pointed out that recovery of nerve function depends to a great extent on the duration of symptoms [5, 7, 9]. In our study, the presence of symptoms for more than one year before operation significantly diminished the chance of satisfactory recovery in cases with CTS, but not in those with posttraumatic entrapment ulnar lesions. Chan *et al.* [2] like Harrison and Nurick [7] found also a reduced rate of satisfactory recovery after surgery in patients whose preoperative symptoms had been present for more than one year. However, they did not distinguish between CTS- and PUN-patients. In this regard, combined stretching and compressive forces at the elbow are thought to interfere with intraneural circulation in the ulnar nerve, resulting

Table 5. *Electrophysiological Findings*

		PUN	CTS	
Preop.	MCV (m/sec)	44 ± 12	45 ± 11	ns
	Proximal Motor Latency (sec)	8.1 ± 2.4	5.6 ± 2.4	$p<0.05$[a]
	Distal Motor Latency (sec)	3.8 ± 1.5	5.5 ± 1.3	ns
	SCV (m/sec)	50 ± 12	46 ± 6	ns
Postop.	MCV (m/sec)	50 ± 11	59 ± 8	$p<0.05$[a]

MCV: motor conduction velocity, SCV: sensory conduction velocity.
[a]: Student's t-test.

Table 6. *Excellent Outcome in Relation to the Duration of Symptoms*

	Duration of symptoms		
	<1 year	>1 year	
PUN[a]	13/19	11/15	ns[b]
CTS[a]	11/12	4/7	$p<0.05$[b]
Total	24/31	15/22	

[a]:Excellent results in relation to the total.
[b]: Fisher's test, ns: not significant.

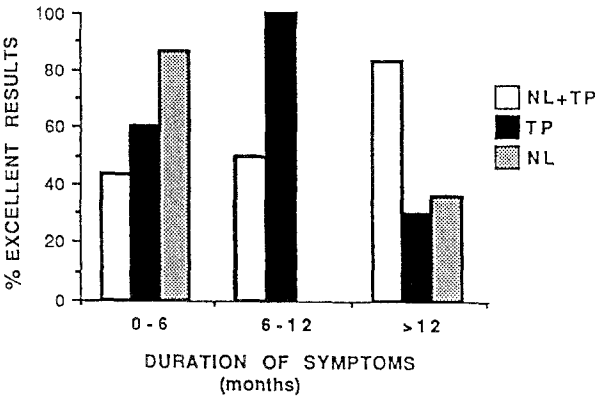

Fig. 3. Excellent results in relation to the duration of symptoms comparing the three surgical techniques. *NL* neurolysis; *TP* anterior transposition

in hyperaemia, oedema and subsequent fibroblastic invasion[16]. Once this time-related fibrosis is established, full relief of symptoms after decompression or transposition is unlikely[5].

Surgical procedures for ulnar nerve release at the elbow have not been adequately compared because of a lack of randomized prospectives studies. The difficulty of performing such investigations lies in the fact that a particular surgical technique like anterior transposition is usually preferred to the more intractable cases. Although there is no agreement about which surgical approach is the most suitable, neurolysis combined with anterior transposition has been proposed as the procedure of choice for patients with posttraumatic ulnar neuropathy at the elbow, especially when structural abnormalities of the elbow joint are present[7, 8, 11, 12]. Simple decompression is preferred for CTS cases[2, 8, 22].

Irrespective the duration of symptoms, our results show that the three techniques provide comparable satisfactory outcomes. However, neurolysis associated with anterior transposition appears to be the most useful treatment for cases with a period of symptoms exceeding 1 year. These findings agree with a previous report comparing outcome after simple decompression to that obtained by anterior transposition[11]. Furthermore, patients with CTS obtained in general slightly better results than patients with PUN, but differences were only significant when neurolysis was applied in combination with anterior transposition.

Neurolysis seems to be a decisive factor for functional recovery in cases with CTS. None of the patients in whom neurolysis was performed failed to regain motor or sensory function. As to the way to do neurolysis, we agree with the limitations reported by Sakurai and Miyaraka[16] concerning the extension of fibrotic tissue removal, in contradiction to other more aggressive techniques[18]. When indicated, endoneurolysis should be done with caution because excessive release of the fibrotic scar inside the nerve could induce a more severe fibrotic reaction after surgery.

The use of neurolysis as the only technique is still a subject of controversy. It has been shown to be useful in patients with short duration of symptoms, macroscopically normal appearance of the nerve or slight epineural fibrosis, and when the majority of the neurologic deficit is sensory[11, 19, 22]. Performed following these criteria, external neurolysis alone was, in our experience, the most effective technique for patients with less than 6 months duration of symptoms.

Contrary to Macnicol[11] and according to others[7, 19], we found that the sensory deficit showed better

improvement than the motor disability. Over one third of all patients in our series complained of sensory impairment at review. At this time, motor dysfunction was detected in more than half of the patients. This is in accordance with our electrophysiological investigation in which mostly patients with PUN did not regain normal motor conduction velocities after treatment. This particularly agrees with the findings reported by Payan [15] where mean conduction velocities at the elbow remained 30% below the normal for both motor and sensory fibers in two thirds of the patients operated upon for ulnar neuropathy. It is thought that a normal conduction velocity is likely never to be regained by regenerated nerve fibers [10, 15]. In this sense, our CTS patients probably had less neural damage than PUN patients because they regained normal conduction velocities after surgery.

Finally, it should be emphasized that non-traumatic (CTS) and posttraumatic (PUN) entrapment neuropathies differ to a certain extent in their clinical and electrophysiological profile and in the response to different surgical approaches. Our observations suggest that they may be considered as two distinct clinical entities.

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