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Simple neurolysis for failed anterior submuscular transposition of the ulnar nerve at the elbow

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Abstract From 1996 to 2000, we reoperated nine patients totally dissatisfied after previous surgery for cubital tunnel syndrome. All patients had simple external neurolysis in situ of the transposed ulnar nerve. Only the anterior aspect of the ulnar nerve was dissected and released. Dense scarring around the ulnar nerve was found to be the main cause of recurrence but could not explain the three initial cases of persistent symptoms. All patients were reviewed 2 years after the secondary neurolysis. The patients were asked to describe their remaining symptoms and examination included palpation of the ulnar nerve at the elbow, Tinel's sign, two-point discrimination, and palpation of the scar. Pinch and grip strength were measured. According to the Wilson and Krout classification, there were four good results with complete alleviation of symptoms, four fair results, and one poor result. Simple neurolysis proved to be effective after failed anterior submuscular transposition of the ulnar nerve at the elbow.

Résumé De 1996 à 2000, nous avons réopéré neuf malades, pour échec de chirurgie antérieure pour syndrome du tunnel cubital. Tous les malades ont eu une neurolyse simple, in situ, du nerf ulnaire transposé. Seule la face antérieure du nerf ulnaire a été disséquée et libérée. Une cicatrice dense autour du nerf a été trouvée comme étant la cause principale de récurrence mais ne pouvait pas expliquer les trois cas initiaux de persistance des symptômes. Tous les malades ont été examinés deux ans après la neurolyse secondaire. On leur a demandé de

décrire leurs symptômes restants et l'examen incluait la palpation du nerf ulnaire au coude, la recherche du signe de Tinel, de la discrimination de deux points et la palpation de la cicatrice. La force de pincement et la force de la prise ont été mesurées. D'après le classification de Wilson et Krout, il y avait quatre bons résultats avec complète disparition des symptômes; quatre résultats moyens et un mauvais résultat. La simple neurolyse à prouvé être efficace après l'échec de la transposition submusculaire antérieure du nerf ulnaire au coude.

Introduction

Various surgical procedures have been advocated for the treatment of cubital tunnel syndrome. In 1996, we decided to favor the submuscular anterior transposition technique over simple neurolysis at the retrocondylar groove, medial epicondylectomy, and subcutaneous or intramuscular anterior transposition. We adopted a slightly modified version of the Dellon's musculofascial lengthening technique [4]. The surgical procedure follows the usual steps advocated by Dellon, but instead of z-cutting the flexor-pronator mass 2 cm distal to the medial epicondyle to get the necessary lengthening, two flaps are elevated: a purely fascial flap with its proximal vascularization (Fig. 1a), and a muscular one with its distal vascularization. The two flaps are then sutured together over the transposed nerve. The ulnar nerve is thus covered by a mixed flap, which is more fascial than muscular (Fig. 1b). This technique could be described as a subfascial–submuscular anterior transposition, but it still pertains to the submuscular category.

Results were globally satisfactory in line with Dellon's prospective evaluation [5] despite inevitable failures. From 1996 to 2000, nine patients were totally dissatisfied by the operation outcome. Once the transposition failure was confirmed by electrodiagnostic studies, these nine well-motivated patients were treated by simple external neurolysis of the ulnar nerve. Few authors have reported their revision results after failed primary decompression of

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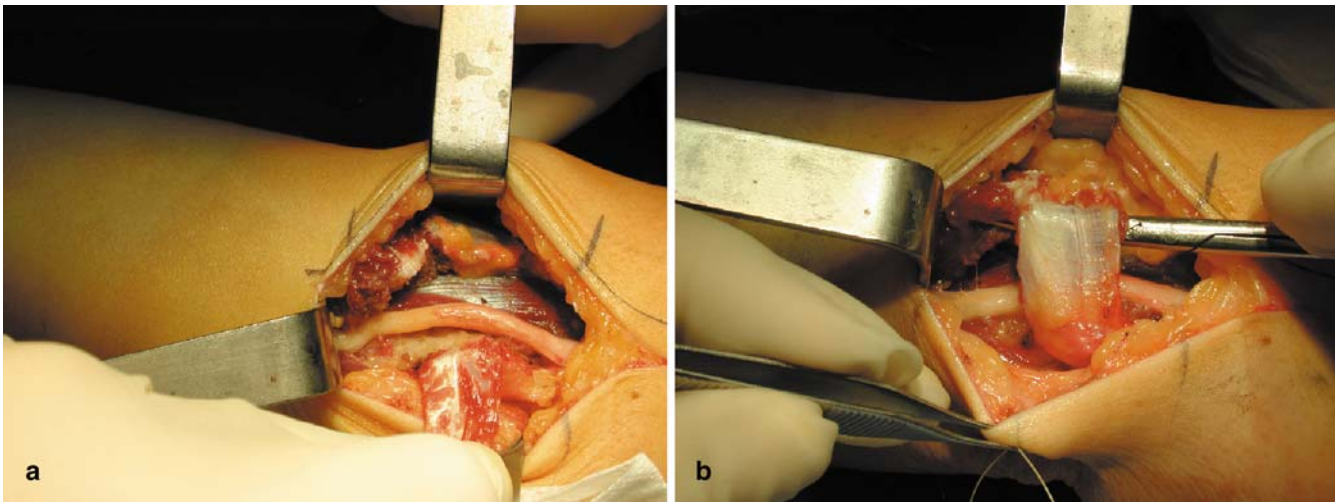


Fig. 1 Subfascial–submuscular anterior transposition of the ulnar nerve. **a** The fascial flap is reflected by the operator. **b** The fascial flap and the muscular flap have been sutured together over the transposed nerve.

the ulnar nerve despite the value of such data. We present the results of our nine-patient series at 2-year follow-up.

Materials and methods

Patients

Of the nine patients, there were two women and seven men. The average age was 47 years with a range of 32–66 years. There was only one left-handed patient. Seven patients did heavy manual labor. The affected side was the dominant side in seven cases out of nine. Those nine patients presented, despite transposition of the ulnar nerve, paresthesias in seven cases, and in four cases electrical discharges when the elbow was extended. In two cases, they dropped objects and in three cases they had an important loss of strength.

In all nine cases, persistence or recurrence of symptoms was confirmed by electrodiagnostic studies, which

showed, in six cases, a decrease of sensory action potential amplitudes in three cases an absence of sensory response, in nine cases a diminution of motor nerve conduction velocity, and in seven cases abnormal electromyographic results.

Six patients had developed new symptoms after an average remission period of 23 months. The three others had never had any remission.

Surgical procedure

The surgical technique used in these nine recalcitrant cases was a simple external neurolysis in situ of the transposed ulnar nerve. Only the anterior aspect of the ulnar nerve was dissected and released. Four photographs illustrate this simple revision neurolysis procedure, which begins proximal to the subfascial–submuscular flap (Fig. 2a) then distal to the flap (Fig. 2b). The subfascial–submuscular

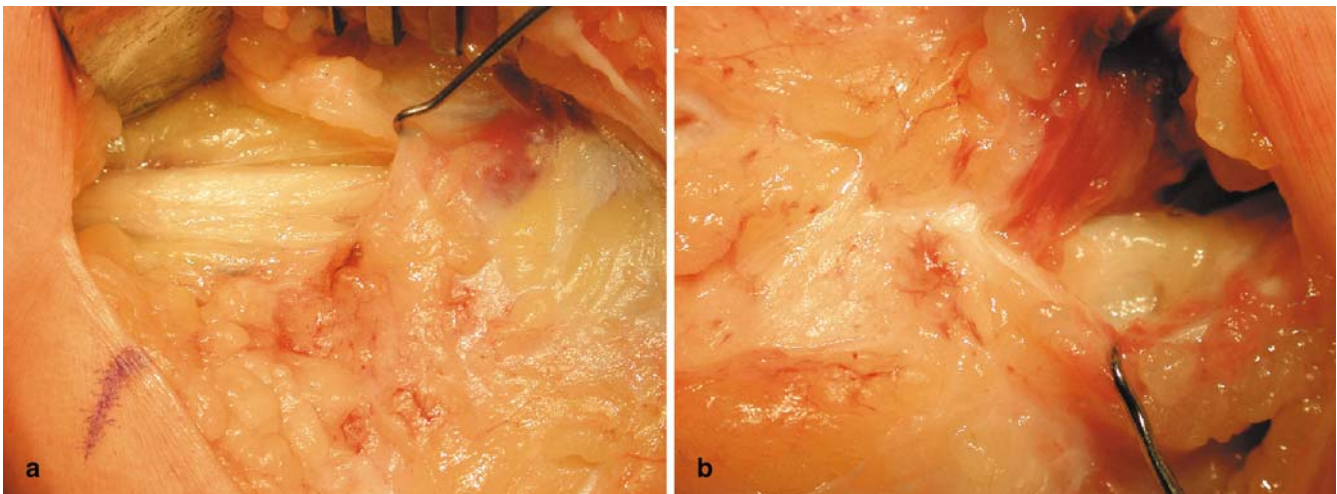


Fig. 2 Simple revision neurolysis in situ. Neurolysis proximal **a** and distal **b** to the subfascial–submuscular flap.

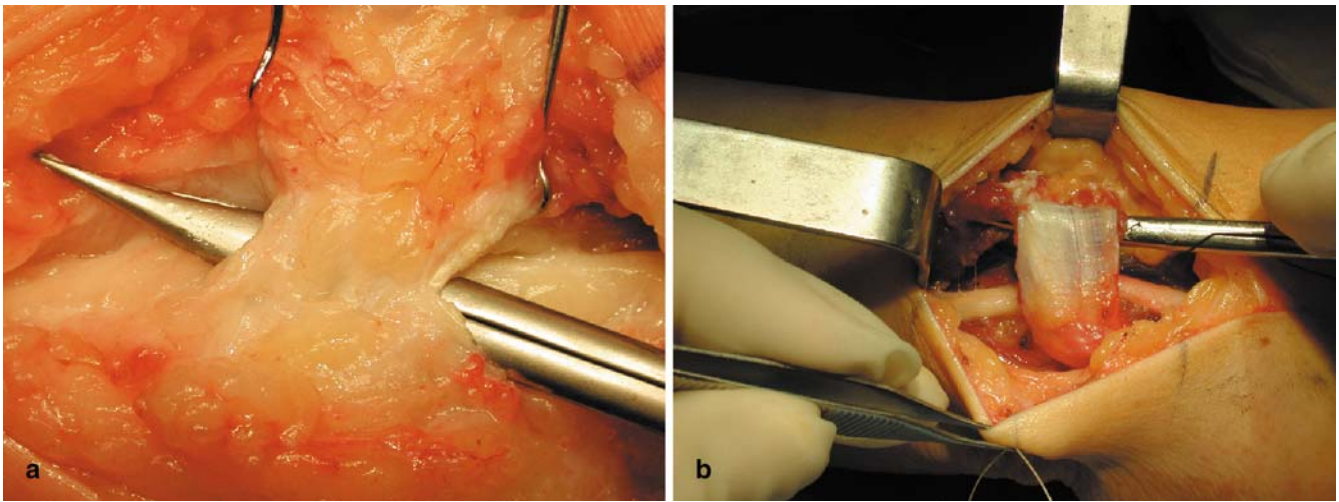


Fig. 3 Simple revision neurolysis in situ. **a** Aspect of the subfascial–submuscular flap. **b** Comparison with the initial aspect of the flap at primary surgery.

flap (Fig. 3a), once dissected, is finally divided (Fig. 4), with special care for the underlying nerve.

Evaluation and follow-up

All patients had regular postoperative clinical follow-ups and were reviewed 2 years after secondary neurolysis. Patients were asked to describe their remaining symptoms, if any: pain in the upper extremity; numbness and paresthesias in the fourth and fifth digit; electrical discharges when extending the elbow; weakness in the hand with reduction in pinch strength. Examination included palpation of the ulnar nerve at the elbow, Tinel’s sign, flexion of the elbow (to produce pain or paresthesias), two-point discrimination, and palpation of the scar (tenderness). Pinch strength (B and L pinch gauge) and grip strength (Jamar dynamometer) were measured and

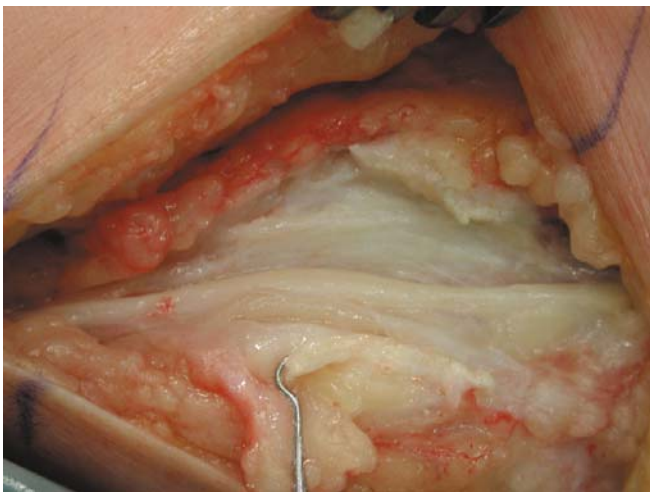


Fig. 4 Simple revision neurolysis in situ. Last step: division of the subfascial–submuscular flap.

compared with the contralateral hand and the preoperative data.

Results

Globally, according to the Wilson and Krout classification [11], there were four good results (complete alleviation of symptoms), four fair results (satisfactory improvement with some recurrence of symptoms), and one poor result (no improvement). When reviewed at 2 years post-operatively, the four patients of the “good results” category, all right-handed with the affected side being the dominant hand side, presented a complete absence of symptoms, had no pain associated with flexion or extension of the elbow, had no tenderness on palpation of the ulnar nerve, felt no electrical discharge produced by elbow extension, and paresthesias had disappeared. They had a normal two-point discrimination test (points of the caliper set at 4 mm). The grip strength of the right hand was measured at 52 kg ranging from 41 kg to 64 kg with a 27% improvement in comparison with the preoperative data. The contralateral side was measured at 47 kg. The key pinch was measured at 11.2 kg ranging from 9.8 kg to 13.1 kg with a 47% improvement in comparison with the preoperative data. The contralateral side was measured at 10.9 kg.

The patients of the “fair results” group were two right-handed men, one left-handed man, and one left-handed woman. The nondominant side was affected in two right-handed patients. All pain had disappeared. Strength was restored with grip strength measured at 42 kg ranging from 19 kg to 59 kg (21% improvement in comparison with the preoperative data), and the contralateral side was measured at 38 kg. But tenderness was noted on palpation of the transposed ulnar nerve at the elbow, and above all, the four patients complained of mild paresthesias with a subnormal two-point discrimination evaluated between 5 mm and 6 mm.

The only patient of the “poor result” group was one the three patients who never had any remission of symptoms. On the contrary, symptoms worsened with important pain in the upper extremity of an ill-defined nature complicated by the existence of lateral epicondylitis, and excruciating pain was noted on palpation of the transposed ulnar nerve or when flexing the elbow. Paresthesias were still present with an absence of discrimination at 10 mm. Grip strength was evaluated at 17 kg against 19 kg before surgery and 55 kg on the contralateral side. Key pinch was measured at 5 kg against 13 kg on the contralateral side.

All nine results were documented by electrodiagnostic studies, which confirmed the absence of abnormalities in the four good results. In the four patients of the fair result group, there were subnormal sensory action potential amplitudes. In the poor result case, electrodiagnostic studies showed an absence of sensory response and a diminution of motor nerve conduction velocity.

Discussion

Four major series of revision surgery for cubital tunnel syndrome have been published. Three groups of authors report the effectiveness of submuscular anterior transposition and recommend it for revision surgery [2, 6, 10]. The fourth one favors the subcutaneous technique over the submuscular technique for primary and revision surgery [3]. Causes for failure of ulnar nerve surgery generally fall into the following categories: failure to decompress; new areas of constriction, for example kinking proximally or distally; scarring, postoperative complications as neuroma, flexion contracture, medial elbow pain, joint instability after medial epicondylectomy, and nerve instability. These complications and pitfalls have been exhaustively detailed by many authors [1, 7, 8, 10].

As demonstrated by Kleinman, anterior transposition is a logical approach to complete nerve decompression [9]. The ulnar nerve cannot be well transposed submuscularly if all sites of compression are not released far enough distally and proximally. We found no forgotten major site of compression in the nine cases, but on the other hand, we have no explanations for the complete failure and the four incomplete results of the revision neurolysis.

Scarring (Fig. 5) is definitively a cause of recurrence. The new environment of the transposed ulnar nerve may be understandably a source of iatrogenic sites of compression. To quote Broudy [2], “dense scarring” around and under the fascial–muscular flap was present in all nine cases. But scarring cannot explain the three cases of persistent symptoms after primary anterior transposition. Intraoperatively we found the ulnar nerve enshrined in a fibrous mass under the flap. Fibrosis had also created the equivalent of fibrous bands proximally and distally to the fascial–muscular flap. This could explain why simple neurolysis in situ was so effective in the six cases of recurrence and also why it failed completely in one case of persistent symptoms.

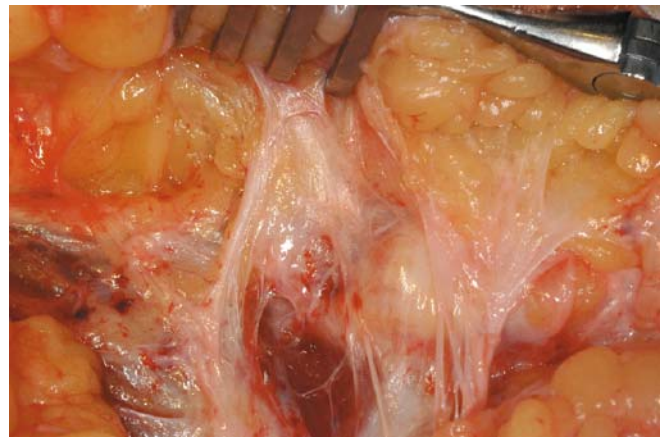


Fig. 5 Secondary entrapment of the ulnar nerve.

We consider the submuscular anterior transposition technique a good solution to protect the transposed ulnar nerve in a stable environment. We therefore excluded the internal neurolysis favored by Broudy [2] and performed an external neurolysis to keep the transposed nerve in its stable environment. Only the anterior aspect of the nerve was released at the level of the divided subfascial–submuscular flap for the same reason. Furthermore, we used neither vein wrapping as proposed by Zyluk [12] nor silicone sheathing, which could be source of nerve instability. Other solutions have been proposed to protect the nerve against possible iterative scarring. Kleinman [9] recommends placing the nerve, once completely relaxed, within a muscle sleeve of the flexor-pronator mass, which seems an interesting solution. In fact, our revision technique transforms the submuscular transposition into a subcutaneous transposition with the advantage of avoiding the risks of nerve instability.

Even though 2 years is a short period of follow-up to evaluate primary or secondary surgery for ulnar nerve decompression, the present short series seems to indicate that poor results after submuscular anterior transposition can be easily and, most of the time, successfully corrected by simple neurolysis of the transposed ulnar nerve in situ. A new evaluation should be planned at 5 years post-operatively to confirm the results.

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