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Original article

Strickland's hypothenar fat pad flap for revision surgery in carpal tunnel syndrome: Prospective study of 34 cases

Le lambeau hypothénarien vascularisé de Strickland dans la chirurgie secondaire du syndrome du canal carpien. Étude prospective à propos de 34 cas

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ABSTRACT

Several techniques are available for revision surgery of carpal tunnel syndrome (CTS) to preserve a gliding layer and protect the median nerve, including Strickland's pedicled hypothenar fat pad flap. The objective of this single-center, prospective study was to report the results of this flap after a minimum follow-up of two years. Between March 2006 and April 2014, 34 patients were enrolled (mean age 67 years) who had postoperative complications after the primary surgical release of CTS with nighttime paresthesia and/or neuropathic pain and abnormal electromyography findings. All patients were operated on using the same technique: neurolysis of the median nerve in the carpal tunnel with the nerve protected by a Strickland flap. The preoperative and postoperative evaluations consisted of questionnaires (paresthesia, neuropathic pain using the VAS and DN4 score, QuickDASH) and a clinical examination (grip strength, Weber two-point discrimination, atrophy of thenar muscles). Eighteen patients were reviewed in person and sixteen over the telephone. The outcomes were analyzed after at least 24 months' follow-up for all patients and 60 months for 13 patients. At 24 months postoperative, nighttime paresthesia was present in 3 of 34 patients and neuropathic pain in 2 of 24 patients. There was a significant reduction in pain on the VAS in all 34 patients (1.4 versus 6.4), the DN4 score (1.3 versus 5.7) and QuickDASH (60.7 versus 19.8). Of the 18 patients examined, grip strength improved from 72% to 86% of the opposite side ($P < 0.05$), the mean static Weber was 6.4 mm (versus 7.1 mm preoperatively); nine patients had atrophy of the thenar muscles (versus eight preoperatively). The results observed at two years were maintained at five years' follow-up. This flap appears to improve the subjective neurological signs of CTS.

Mots clés :
Canal carpien
Nerf médian
Douleurs neuropathiques
Lambeau vascularisé
Lambeau de Strickland

RÉSUMÉ

Dans la chirurgie de reprise du syndrome du canal carpien, afin de conserver un plan de glissement et de protection pour le nerf médian, plusieurs techniques existent, dont le lambeau hypothénarien vascularisé de Strickland. L'objectif de cette étude prospective monocentrique était de rapporter les résultats de ce lambeau avec un recul minimum de deux ans. De mars 2006 à avril 2014, ont été inclus 34 patients, d'âge moyen 67 ans, qui présentaient une complication postopératoire après chirurgie première d'un syndrome du canal carpien avec paresthésies nocturnes et/ou douleurs neuropathiques et anomalies électrophysiologiques. Ils ont été opérés selon la même technique : neurolyse du nerf médian dans le canal carpien avec protection du nerf par lambeau de Strickland. Une évaluation clinique pré- et postopératoire par l'interrogatoire (paresthésies, douleurs neuropathiques selon l'échelle visuelle analogique EVA et le score DN4, score QuickDASH) et l'examen clinique (force de poigne, test de Weber statique, amyotrophie des muscles thénariens) a été réalisée. Dix-huit patients ont été revus en consultation et 16 ont eu une évaluation téléphonique. Les résultats ont été recueillis au recul de 24 mois minimum pour tous les patients et de 60 mois pour 13 d'entre eux. À 24 mois, on notait des paresthésies

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nocturnes (trois cas contre 34), des douleurs neuropathiques (deux cas contre 24) avec une amélioration significative dans les 34 cas de l'EVA (1,4 contre 6,4), et des scores DN4 (1,3 contre 5,7) et QuickDASH (60,7 contre 19,8). Sur les 18 patients examinés, la force de poigne était passée de 72 à 86 % du côté opposé ($p < 0,05$), le test de Weber statique moyen était de 6,4 mm (contre 7,1 mm en préopératoire), neuf présentaient une amyotrophie des muscles thénariens (contre huit en préopératoire). Les résultats constatés à deux ans s'étaient maintenus à cinq ans de recul. Ce lambeau semble donner de bons résultats sur les signes neurologiques subjectifs.

1. Introduction

The failure rate of surgical treatment for carpal tunnel syndrome (CTS) ranges from 3 to 20%, no matter which surgical technique is used [1–6]. The failures can be attributed to incomplete release of the median nerve due to inadequate opening of the flexor retinaculum, formation of scar adhesions and perineural fibrosis, or a secondary cause [7–11]. Revision surgery is not rare (0.3 to 3%) [12–14]. During the re-operation, neurolysis the median nerve only is often not sufficient, especially in the case of perineural fibrosis. The median nerve may need to be covered to protect it and to preserve a gliding layer, along with improving its nutritional and vascular environment [15,16]. Several techniques have been described to accomplish this [17], including the hypothenar fat pad flap by Strickland et al. [18]. There are only a few studies reporting the outcomes with this flap [18–23] and the indications have not been well defined.

The objective of this single-center, prospective study was to report the results of the hypothenar flap for secondary surgery of CTS complications after a minimum follow-up of two years and to define the indications.

2. Patients and methods

2.1. Study population

Between March 2006 and April 2014, 34 patients (19 men, 15 women) were enrolled (mean age 67 years, range 36 to 91) who were seen in multidisciplinary consultation (hand surgeon, electromyography neurologist, pain specialist) and who had postoperative complications after primary surgical release for CTS with nighttime paresthesia and/or neuropathic pain with abnormal electromyography findings.

All patients had a symptom-free period that ranged from 5 to 240 months (mean 61 months). Before the decision to undergo revision surgery, all patients had undergone antiepileptic neuroleptic treatment (pregabalin) that was not sufficiently effective.

The first surgery had been performed at our center in 10 patients and at another facility in 24 patients. A minimally-invasive approach was used in 85% of cases and an endoscopic procedure according to Agee et al. in 15% of cases [24]. All patients had been operated on only once.

The right hand was involved in 59% of cases and the dominant hand in 65%.

Eighteen patients (53%) were still working; 12 did manual labor. Fifteen patients smoked (44%) an average of 20 pack-years. Four patients (12%) suffered from Type II diabetes that was under control.

Clinically (Table 1), along with the paresthesia present in 100% of patients, neuropathic pain was present in 70% of cases (burning in 41% of patients, electric discharge in 53%, painful cold sensation in 18% and itching 21%), hypoesthesia to touch and needle prick in 94% of cases and atrophy of thenar muscles in 23% of cases. The Tinel sign was not evaluated since it is non-specific, nor was the Phalen test done.

Before the revision surgery, all patients underwent an electroneuromyography (ENMG) to confirm the lack of normalization of distal motor latency (greater than 3 m/s) and sensory conduction velocity (lower than 40 m/s), without conduction block.

2.2. Surgical technique

The same surgical technique was used in all patients (Fig. 1). The surgical technique, which was performed under regional anesthesia with an arm tourniquet, combined median nerve neurolysis under magnification with coverage by a vascularized hypothenar fat pad flap according to Cramer's original method described in 1985 [25], as modified by Strickland et al. in 1996 [18] and Guinta et al. in 1998 [26]. Flap vascularization is ensured by a collateral branch stemming directly from the radial side of the ulnar artery in Guyon's canal, about 1 cm distal to the distal wrist crease [18].

The approach was slightly offset medially relative to the previous skin incision and extended proximally and distally to ensure complete exposure of the nerve and mobilization of the flap.

The neurolysis was only perineural, and continued until the median nerve was completely released with resection of all scar tissue. Intraoperative observations showed that all patients had an area of median nerve atrophy with scar adhesions to the previous incision of the flexor retinaculum and perineural fibrosis without intraneural fibrosis; however, it was impossible to determine visually whether neurological compression persisted.

After the ulnar nerve and ulnar artery were identified, the fat pad flap was then mobilized from the hypothenar area. Dissection started on the ulnar side, went through the subcutaneous fat tissue, up to the fascia of the abductor digiti minimi, and then continued on the radial side to Guyon's canal. The perforating vessels stemming directly from the ulnar artery were identified visually but not dissected.

The rectangular flap measured about 4 cm in length and 3 cm in width. It was turned over like a page in a book to cover the released median nerve. The ulnar side of the flap was sutured to the radial edge of the flexor retinaculum with small absorbable suture

Table 1
Population characteristics.

Patients	34
Men	19
Women	15
Side	
Right	20
Left	14
Mean age (years)	67 (range 36 to 91)
Paresthesia with pain (patients)	34
Neuropathic pain (patients)	24
Burning	14
Electric shocks	18
Cold-induced pain	6
Itching	7
Follow-up (patients)	
2 years	34
5 years	13

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