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Published in:
Journal of Hand Surgery (European volume)

DOI:
[10.1177/1753193420970022](https://doi.org/10.1177/1753193420970022)

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Document Version
Publisher's PDF, also known as Version of record

Publication date:
2021

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Ruettermann, M. (2021). Challenging the dogma: anterior transposition of the ulnar nerve is indicated in recurrent cubital tunnel syndrome. *Journal of Hand Surgery (European volume)*, 46(1), 45-49.
<https://doi.org/10.1177/1753193420970022>

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Challenging the dogma: anterior transposition of the ulnar nerve is indicated in recurrent cubital tunnel syndrome

Journal of Hand Surgery
(European Volume)
2021, Vol. 46(1) 45–49
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DOI: 10.1177/1753193420970022
journals.sagepub.com/home/jhs

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Abstract

The current evidence for treatment of primary idiopathic cubital tunnel syndrome favours an in situ release. However, anterior transposition of the ulnar nerve remains a popular procedure in recurrent cubital tunnel syndrome. For more than 20 years, I have performed an extended in situ release only, and achieved similar or better results than with nerve transposition. In performing a systematic review of the evidence for surgery for recurrent cubital tunnel syndrome, I could only include 16 out of 296 studies regarding treatment of recurrent cases of cubital tunnel syndrome. A meta-analysis was not possible, due to selection bias and disparity of outcome measurements of the studies. However, I could not find robust evidence that supports the need of an anterior transposition of the ulnar nerve in recurrent cubital tunnel syndrome over an in situ decompression. My own experience of an extended in situ release with complete neurolysis with reasonable outcomes, in combination with the lack of literature support of anterior transposition in recurrent cases, have led me to the consideration that this dogma should be revised.

Keywords

Cubital tunnel syndrome, ulnar nerve compression, recurrence, systematic review, dogma, anterior transposition

Date received: 5th July 2020; revised: 6th October 2020; accepted: 9th October 2020

Introduction

There is considerable debate over the surgical treatment of cubital tunnel syndrome. The surgical methods described include isolated in situ decompression, or combined with anterior transposition (subcutaneous, subfascial, intramuscular or submuscular), with or without medial epicondylectomy. The incidence of recurrent or persistent cubital tunnel symptom has been estimated to be around 25% (Puckett et al., 2011). If a primary cubital tunnel release had failed to relieve symptoms, a revision release with anterior transposition of the ulnar nerve was commonly used (Bartels and Grotenhuis, 2004; Broudy et al., 1978; Davis and Bulluss, 2005; Gabel and Amadio, 1990; Goldfarb et al., 2009; Holmberg, 1991; Rogers et al., 1991). Vogel et al. (2004) further recommended a submuscular transposition after failed subcutaneous transposition. Additional techniques like saphenous vein wrap (Kokkalis et al., 2010; Varitimidis et al.,

2000), silastic sheeting (Campbell et al., 1974) or collagen nerve wrap (Soltani et al., 2014) have also been described.

For primary cubital tunnel syndrome, the idea that a better result can be achieved with anterior transposition of the ulnar nerve, as opposed to in situ neurolysis, has been shown to be unsubstantiated in prospective randomized studies (Bartels et al. 2005; Biggs and Curtis, 2006; Gervasio et al., 2005) as well as in several systematic reviews and meta-

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analyses (Said et al., 2019). Notwithstanding these data, re-release with anterior transposition of the ulnar nerve remains a common and widely held surgical option for recurrent cubital tunnel syndrome.

The aim of this article is to challenge the dogma that nerve transposition should be performed in recurrent cases. We performed a systematic review of the literature on the surgical treatment of recurrent cubital tunnel syndrome to assess the quality and strength of evidence and describe my own preferred method.

Methods

A systematic review was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement (Moher et al., 2009).

Search strategy

A comprehensive search strategy was compiled with a comprehensive list of terms and synonyms for the operative treatment of recurrence of cubital tunnel syndrome (Online Appendix S1). The following databases were searched from inception until 10 May 2020: PubMed, Embase, Scopus, Google Scholar, Cochrane Library. Two researchers independently examined the references of the retrieved studies to identify additional potentially relevant studies. Any discrepancies or disagreements were discussed; a referee was deemed not necessary owing to the paucity of available studies that fit the inclusion criteria.

Eligibility criteria and study selection

As the overall number of studies was limited, all studies with any patient group size were included, except for single-case reports and cadaver studies. The search was restricted to the English language. We included secondary operations due only to recurrence of symptoms, and not any other causes, for example iatrogenic injuries. The study selection is shown in a PRISMA flow diagram (Online Figure S1).

Data management and risk of bias assessment

Demographic characteristics, preoperative diagnostics, such as electrophysiologic test results, types of primary and revision surgeries were extracted from the text, tables and supplementary material of the selected articles. Additionally, intraoperative findings, outcomes of primary and revision surgeries, as well as complications, were investigated. Risk of bias was assessed

using the Newcastle-Ottawa Quality Assessment Scale (NOS) for one case-control study, which went on to demonstrate such a risk of bias, as stated by the authors themselves (Wells et al., 2014). The one systematic review in our list included the aforementioned case-control study as the highest level of evidence study; all others were level of evidence IV or V. The case series were appraised by the Joanna Briggs Institute critical appraisal tool for case series (Munn et al., 2019). All of them showed bias in the selection of participants, in the outcome measurements and the selection of the reported results. Missing data remained a major limitation in several of the identified studies. For these reasons, a meta-analysis could not be performed; a narrative synthesis is also not presented as this does not give any new insights.

Results

As compared with the systematic review from Kholinne et al. (2019), additional articles were found that met the inclusion criteria; all but one of these were published before 2019. Still, the articles had not been included in the earlier systematic review as a few of these reported on carpal and cubital tunnel recurrences, although patient data per syndrome were specified that allowed extraction for our study.

Study design characteristics

There was one systematic review (without meta-analysis) (Kholinne et al., 2019) and one case-control study comparing re-operations with primary operations (Aleem et al., 2014). Currently, there is no randomized-controlled trial available to shed light on the question regarding which operative technique is most suited for recurrent cubital tunnel syndrome. The remaining 14 studies were either case series or observational studies with level IV or V evidence. Only one study directly investigated operative alternatives for the treatment of cubital tunnel syndrome recurrence (Filippi et al., 2001). These authors describe improvement of symptoms, with all seven patients becoming pain free after the ulnar nerve was transposed back into its original sulcus, after previous subcutaneous anterior transposition. In contrast, only 11 or 15 patients had reduced pain after external neurolysis or subcutaneous transposition. However, there was no statistical analysis to back up their conclusions.

Outcome measures

Different outcome measurements were used at varying time points in the included studies. The same

issue has been described for primary cubital tunnel syndrome (Gallo et al., 2020). As a result, there were insufficient data for a meta-analysis. The operative techniques applied in the included studies consist of re-neurolysis in situ (also after a previous transposition), groove plasty, anterior transposition from subcutaneous to submuscular level, as well as transfer of the previously anteriorly transposed ulnar nerve back into its original sulcus. None of the included studies statistically compared the outcomes of different operative methods for surgery of recurrent cubital tunnel syndrome. Descriptive outcomes of the studies are as shown in Online Tables S1 and S2.

Discussion

Patients that underwent surgery for recurrent cubital tunnel syndrome in the included studies often had an anterior transposition. I believe this is a dogma that is neither supported by evidence reported nor by outcomes from my own practice. A survey by DeGeorge and Kakar (2019) regarding decision-making factors for hand surgeons in the United States regarding ulnar nerve transposition in cubital tunnel surgery, demonstrated that 84% of respondents evaluated ulnar nerve instability preoperatively with clinical examination, and that the intraoperative perception of a 'subluxing' ulnar nerve was the strongest influencing factor to perform an anterior transposition. Half of these surgeons made the decision to transpose intraoperatively, but there were no precise indications for degrees of ulnar nerve instability, with substantial inter-rater variability demonstrated. I consider what we are palpating can often be a part of the triceps muscle or just physiologic movement of the ulnar nerve within the cubital tunnel, as has been demonstrated by ultrasound investigations (Okamoto et al., 2000).

High-quality evidence from prospective randomized studies regarding primary cubital tunnel syndrome demonstrated no difference in outcome between open in situ release and anterior transposition of the ulnar nerve at the elbow (Bartels et al., 2005; Biggs and Curtis, 2006; Caliandro et al., 2011; Said et al., 2019). The most recent and comprehensive meta-analysis by Said et al. (2019) did not find any significant differences in the rate of revision surgery between in situ release and anterior transposition; however, there were significantly more complications associated with anterior transposition. They concluded that proper surgical technique with attention to avoiding iatrogenic injury, meticulous haemostasis and adequate decompression might be more important than the method of decompression.

This is in line with my own experience and results using an extended in situ release for recurrent cubital tunnel syndrome.

Gaspar et al. (2016) reported a revision rate of 3.2% (7 of 216) after in situ release of the cases in their study (Oxford evidence level III) for idiopathic cubital tunnel release. Zhang et al. (2017) found a rate of secondary surgery of 5.7%: 2.5% for in situ cubital tunnel release, and 11% for ulnar nerve transposition in a retrospective cohort study (Oxford evidence level IV) of 234 patients with 157 in situ releases and 90 anterior transpositions (some patients who had bilateral surgeries). Dagregorio and Saint-Cast (2004) described successful simple neurolysis for recurrent cubital tunnel syndrome in all cases after failed anterior submuscular transposition, without any control group (Oxford evidence level V). With different standards in pre- and post-operative diagnostics and the variety of methods of outcome measurement, no robust data exists for a detailed meta-analysis.

Yalcin et al. (2013) found unilateral asymptomatic ulnar nerve subluxation in 11% of their population, involving 72 healthy volunteers, when establishing reference values for the use of ultrasound scanning of the ulnar nerve. According to Okamoto et al. (2000), transient ulnar nerve dislocation can be found in up to 20% of asymptomatic individuals, and these authors postulated that this translation is abnormal and can predispose to nerve irritation and direct nerve injury. These reports indicate that instability or even dislocation often does not cause clinical problems. Therefore, there is little reason to base our decision solely on this intraoperative finding.

In a prospective study involving 40 healthy volunteers and 18 patients with cubital tunnel syndrome, Kutlay et al. (2009) found that the cross-sectional area of the ulnar nerve changes with flexion and extension of the elbow to a statistically significant level ($p < 0.001$). They also found that the severity of subluxation in the patient group leads to an increase in the cross-sectional area of the ulnar nerve, that was larger in patients with more severe symptoms. In these patients, they found compressions sites of the ulnar nerve to be more distal and proximal to the epicondyle. Consequently, they performed a more extended decompression of the ulnar nerve proximally and distally through longer incisions in these patients for effective releases, and none of their patients subsequently required revision surgery.

My personal experience

My own personal experience of more than 20 years in treating primary peripheral nerve problems and

Figure 1. Ulnar nerve constriction by fascial band 7 cm distal to the medial epicondyle (white arrow) [endoscopic view].

when treating patients referred for second or third opinions, has taught me that recurrent, as well as persistent complaints of cubital tunnel syndrome do not necessarily require an anterior transposition. I see many patients with recurrences or persistent pain after as many as eight operations on the same ulnar nerve; some of these cannot be improved by further surgery and require treatment instead for neuropathic pain due to iatrogenic reasons. On average, I operate on approximately 40 patients with cubital tunnel syndrome yearly, 15% to 20% of which are recurrent cases. I had not performed an additional anterior transposition in these patients over the past 20 years. There were instances I repositioned a previously transposed nerve combined with a more extended neurolysis or placed it back into the sulcus. At least to my knowledge, these patients did not need further surgery for persistent nerve compression thereafter. I believe neurolysis, i.e. excision of any scars or scarred epineurium around the nerve without intraneural neurolysis, over a sufficiently long distance is sufficient for recurrent cases.

My colleagues and I have reported that there was no difference in outcomes between a minimally invasive technique using a speculum or a completely endoscopic approach, as long as there is an adequate length of in situ neurolysis within the cubital tunnel, and if we have addressed any other possible anatomic compression sites around the elbow (Bolster et al., 2014). In my experience with recurrent cases, this conclusion also holds true.

In recurrent cases, my routine practice over past 20 years has been an endoscopic approach, which enables me to use a short incision within the old scar. Full release of any compressions of the ulnar

Figure 2. Fascial bands that can cause ulnar nerve compression distal to the cubital tunnel (with permission from Hoffmann and Siemionow, 2006).

nerve proximally and distally is feasible with optimal visual control (Figure 1). Extra attention is paid to the area under the flexor carpi ulnaris muscle, as there are thicker parts of the submuscular membrane that can compress the ulnar nerve depending on the position of the elbow and frequent use of power grip of the hand (Hoffmann and Siemionow, 2006; Matsuzaki, 2001) (Figure 2). In my experience, avoiding further devascularization of the ulnar nerve and preventing extensive scarring remains the key.

Acknowledgements The author thanks Dr. Jill Gwiasda for her advice and help with the systematic review.

Declaration of conflicting interests The author declares no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding The author received no financial support for the research, authorship, and/or publication of this article.

Informed consent The patient depicted consented to the use of the intraoperative photograph.

Supplemental material Supplemental material for this article is available online.

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