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Endoscopic cubital tunnel release: a systematic review

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Abstract

Introduction: Theoretical advantages of endoscopic cubital tunnel release are the short incision, lower risk of nerve damage, reduced manipulation of the nerve and possible faster recovery.

Sources of data: We systematically searched Medline (PubMed), Web of Science and Scopus databases using the following keywords: 'endoscopic ulnar nerve', 'endoscopic cubital nerve', 'endoscopic ulnar compression' and 'endoscopic ulnar neuropathy'. Twenty-one studies were included in this review. The quality of the studies was assessed using the Coleman Methodological Score.

Areas of agreement: Endoscopic release is effective for cubital tunnel entrapment and allows adequate visualization of the site of entrapment. There is a negative association between the severity of the compression and reported outcomes. Injury to the medial branch of the antebrachial cutaneous nerve is less frequent thanks to the limited dissection. The most frequent complication is the development of a hematoma.

Areas of controversy: It is unclear whether ulnar nerve instability is a contraindication to simple decompression.

Growing points: The shorter time to return to work and the cosmetic appearance of the scar can be considered advantages of the endoscopic technique.

Areas timely for developing research: There is a need to perform randomized clinical trials with common and validated scoring system with a longer duration of follow-up. The literature pertinent to endoscopic cubital tunnel release is lacking in the evaluation of the learning curve. Further investigations are necessary to assess the role of ulnar nerve instability.

Key words: ulnar nerve, cubital canal, endoscopic release, neuropathy, systematic review

Introduction

Cubital tunnel syndrome (CuTS) is the second most common form of nerve entrapment after carpal tunnel syndrome,[1] with an incidence of 18–25 per 100 000 individuals per year.[2,3] Static and dynamic factors are involved, leading to ischemia or mechanical compression, secondary to repeated elbow flexion, anatomic variants of muscles and ulnar nerve subluxation. The first approach is non-operative, especially in patients with mild symptoms, in whom exercises, elbow splinting in extension, limitation of motion between 40° and 70° or maneuvers improving the gliding of the ulnar nerve may provide symptomatic benefit. When conservative management fails, surgery is indicated.[4] Many procedures have been described: simple decompression, anterior transposition of the ulnar nerve (subcutaneous, submuscolar or intramuscular), medial epicondylectomy and endoscopic decompression. There is no consensus on the best technique. Anterior transposition has been considered the gold standard for many years, but it has been shown that simple decompression[5] provides comparable outcomes to decompression and transposition. Also, anterior transposition has higher complication rates: the fact that the nerve has to be removed away from its natural bed induces marked devascularization, perineural fibrosis, elbow stiffness from prolonged immobilization, kinking of the nerve in elbow flexion and occurrence of entrapment at different levels. Endoscopic release of the cubital tunnel (ECuTR) has been first described by Tsai[6] and later modified by Hoffmann.[7] Theoretical advantages of this technique are the short incision, low risk of damage to the posterior branch of the medial antebrachial cutaneous nerve, reduced manipulation of the nerve and less extensive dissection, all factors predictive of faster recovery. This review aims to ascertain whether endoscopic release of the cubital tunnel provides better outcomes and faster return to work compared with traditional procedures, and it also describes the occurrence of related complications. In addition, we also propose to assess the methodological quality of the studies published on this topic.

Methods

We performed a systematic review of the literature according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines with a PRISMA checklist and algorithm.[8] A literature search was performed combining the following keywords: 'endoscopic ulnar nerve', 'endoscopic cubital nerve', 'endoscopic ulnar compression' and 'endoscopic ulnar neuropathy', with no limitations for year of publication. Medline (PubMed), Web of Science and Scopus were accessed up to April 2015. Articles in English, Spanish, Italian and French languages were identified, all published in peer-reviewed journals, reporting clinical data of patients undergoing ECuTR procedure. Biomechanical studies, studies on animals or cadavers, technical notes, letter to the editor and instructional courses were excluded. Two authors (ADB and FS) independently assessed the abstract of each publication. When it was not possible to include or exclude an article based on the abstract, a full-text version of the article was downloaded. If the abstract was not available, the article was excluded from the study. In addition, we retrieved the reference list of each selected article to identify additional studies missed at the first electronic search. The two investigators assessed each study according to the Coleman Methodological Score (CMS),[9] ranging from 0 to 100, according to which a 100 score is referred to the best study design (Table 1). Both investigators performed the CMS assessment twice, with a 10-day interval between the 2 evaluations. Then, they discussed the scores when more than a two-point

Table 1 Coleman methodology score

Category	Criteria	Score
Part A (score for each section)		
Study size: number of patients	<15	0
	15–24	4
	25–40	7
	>40	10
Mean follow-up (years)	<1	0
	1–2	4
	2–5	7
	>5	10
Number of different surgical technique	Not stated	0
	Several technique but clearly stated	5
	>1 technique but >90% receiving one technique	7
	One technique	10
Study type	Case report	0
	Case series	2
	Retrospective comparative study	3
	Prospective cohort study	10
	Randomized control trials	15
Description of surgical technique	Inadequate/not clear	0
	Fair (technique only stated)	3
	Detailed (description of materials used)	5
	Precise and details (pictures/diagrams)	10
Postoperative management/rehabilitation	Not formalized	0
	Yes but unclear	2
	Yes and clear	5
Complication discussed	Unclear/not mention	0
	Complications mentioned but unclear	5
	Complication fully discussed	10
Part B (score for each option)		
Outcome criteria	Return to work	3
	Patient's satisfaction	3
	Objective measurements	2
	Nerve conduction study	2
Procedure of assessing outcome	Surgeon independent from author	3
	Written assessment	3
	Nerve conduction study used	2
	Analysis of medical records	2
Description of subject selection process	Not responsive to conservative treatment	2
	Clear description of the process	3
	Exclusion criteria clear	3
	Diagnostic method described	2

difference was present, until a consensus was reached. Data on demographic features, operative readings, diagnostic methods, follow-up periods, type and rates of complications, return to work activity and outcome measures were recorded.

Results

A total of 651 studies were identified at the first search. Of 28 studies selected based on the search, 2 studies were excluded as the full text was not available, and 5 studies were excluded after reading the full text.

Finally, 21 publications relevant to the topic were included (Fig. 1). Different surgical techniques were used, all aiming to decompress the nerve using the endoscope. The main difference among the procedures was the extent of the release of surrounding soft tissues.

All the studies were published between 1995 and 2014; the total number of patients operated on was 1721 (55% males, 45% females); gender data were not available in 11 studies. The mean age at surgery was 50 years (range 17–92); the mean follow-up was 19.3 months, ranging from 5[10] to 92[11] months.

In six studies, patients underwent surgery after failure of conservative treatment.[12–17] Criteria for patient exclusion were preoperative subluxation[13,16,18] and previous surgery.[12,13,15,18–20] In the remaining studies, patient selection criteria were not reported.

In all the studies, the diagnosis was made based on clinical findings and nerve conduction studies. Preoperatively, patients were classified according to the Dellon classification[11] in nine studies[7,12–14,17,19–22] and the McGowan classification[23] in six studies.[15,18,24–27] The Dellon classification assesses the severity of the neuropathy through the examination of the motor function of the ulnar nerve and subjective sensory symptoms. The McGowan classification considers the loss of the motor function of the ulnar nerve without taking into account sensory changes. The Disability of Arm, Shoulder and Hand (DASH) score[28] was administered in two studies[17,20]; the Gabel and Amadio classification,[29] which measures pain, motor and sensorial abnormalities, was used in one study.[17]

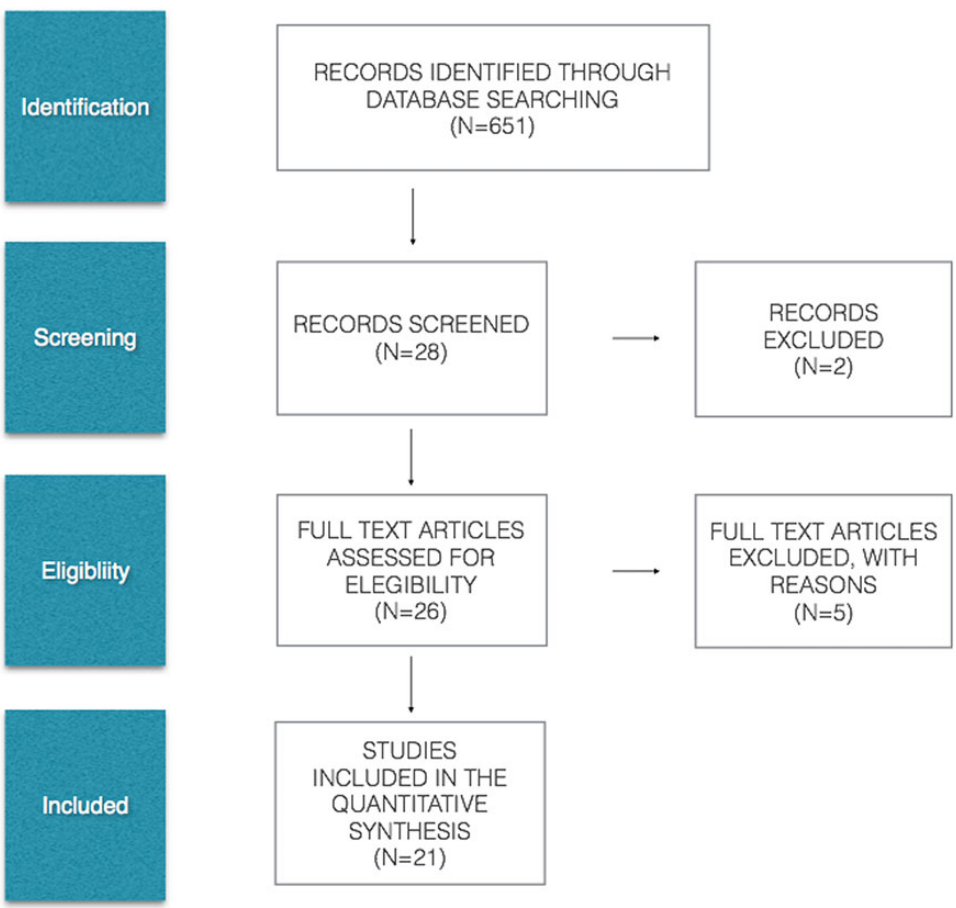

Fig. 1 PRISMA flow diagram.

The surgical technique was adequately described in 20 of 21 studies. Different surgical techniques were used, with different devices, but the general principle was to achieve the decompression through an endoscope, with a 2 cm incision. The main difference among techniques was the extent of the release of constraining structures. The postoperative rehabilitation protocol was well described in 6 studies,[7,10,13,14,22,27] not satisfactorily described in 10 studies[6,12,15,17,19–21,30–32] and not mentioned in 5 studies.[16,18,24–26]

Quality assessment

A Coleman score of >85 is considered excellent, 70–84 good, 50–69 moderate and <50 poor. The mean CMS was 56.3 (range 34–82), indicative of moderate methodological quality. The articles selected and the Coleman scores are shown in Table 2. Quality scores were good in 2 studies,[12,22] moderate in 14 studies[6,7,13–20,24,27,31,32] and poor in 5 studies.[10,21,25,26,30] The lowest scores were found within the categories length of follow-up, study type and outcome assessment.

Postoperative outcomes

To report results, common and validated scoring systems were used (Table 3): the Bishop rating system,[33] which includes subjectives and objectives features, was used in 10[7,12,14,16,19–22,27,32] studies (47%); the McGowan classification system was used in 3 studies[15,25,26]; and the DASH score[28] was used in 2 studies.[17,20] Patient satisfaction was graded according to the Likert scale (excellent–good–satisfactory–fair–poor) in five studies.[13,15,25,26,31] A self-evaluation questionnaire was used in 1 study (14).

After surgery, the nerve condition was examined to assess the recovery of the nerve in seven articles[7,12,16,19,21,24,31]; two-point discrimination was assessed in three studies,[12,17,18] showing post-operative improvement from 23[18] to 95%[17] of patients. Grip and pinch strength were evaluated in

Table 2 Study features

Authors	Number of patients	Follow-up (months)	Type of study	CMS
Tsai *et al.*[6]	26	6	Case series	55
Tsai *et al.*[12]	76	32	Case series	70
Nakao *et al.*[30]	8	6	Case series	34
Hoffmann and Siemionow[7]	76	11	Case series	58
Ahcan and Zorman[31]	36	14	Case series	59
Ward and Siffri[13]	18	12	Case series	61
Watts and Bain[18]	55	12	Prospective cohort study	63
Yoshida *et al.*[24]	35	25,9	Case series	52
Stadie *et al.*[25]	29	23	Case series	48
Oertel *et al.*[26]	26	12	Case series	42
Flores[21]	13	6	Case series	43
Cobb *et al.*[14]	94	24	Case series	60
Leclere *et al.*[32]	55	21	Case series	52
Mirza *et al.*[10]	52	5	Case series	44
Dutzman *et al.*[27]	114	24	Retrospective comparative study	67
Saint-Cyr *et al.*[19]	117	13	Retrospective comparative study	59
Cobb *et al.*[22]	148	30	Prospective cohort study	82
Bacle *et al.*[15]	502	92	Retrospective comparative study	61
Martin *et al.*[16]	107	24	Retrospective comparative study	64
Bolster *et al.*[20]	42	6	Prospective cohort study	57
Mirza *et al.*[17]	92	8,2	Case series	51

Table 3 Common and validated score system outcomes

Authors	Bishop's score (excellent + good %)	DASH score (0–100)	Likert-type satisfactory scale (excellent + good %)
Tsai *et al.*[6]			
Tsai *et al.*[12]	87%		
Nakao *et al.*[30]			
Hoffmann and Siemionow[7]	89%		
Ahcan and Zorman[31]			91%
Ward and Siffri[13]			87%
Watts and Bain[18]			79%
Yoshida *et al.*[24]			
Stadie *et al.*[25]			80%
Oertel *et al.*[26]			85%
Flores[21]	92%		
Cobb *et al.*[14]	94%		
Leclere *et al.*[32]	92.5%		
Mirza *et al.*[10]			
Dutzman *et al.*[27]	88%		
Saint-Cyr *et al.*[19]	86%		
Cobb *et al.*[22]	96%		
Bacle *et al.*[15]			93%
Martin *et al.*[16]	72.7%		
Bolster *et al.*[20]	91%	23	
Mirza *et al.*[17]		25	

five studies.[7,12,13,17,18] Return to work after surgery, cost effectiveness of surgery and the relationship with work compensation status were assessed in six studies.[12,17,19,21,22,27] All the studies except two[20,27] agree on the shorter return to work after endoscopic release.

Complications

Postoperative complications were reported in 20 studies. In two studies, no patients reported complications.[21,24] Postoperative hematoma occurred in 9 studies,[7,10,12,16,18,22,27,31,32] ranging from 0.7% (1 of 148 patients)[22] to 5.3% (4 of 75 patients),[7] for an average of 2.7%. Intraoperative subluxation occurred in 4 studies, which was managed in all instances by converting the procedure to open surgery[13,17,26,27] from 1% (1 of 92 patients)[17] to 33% (6 of 21 patients).[13] A superficial infection and complex regional pain syndrome were each seen in 1 patient (1 of 75 patients).[7] One patients developed thrombophlebitis 2 weeks after surgery (1 patients of 75).[7] Recurrence, described as a new presentation of symptoms within 3 months, was analyzed in 4 studies,[12,14,15,22] from 0% (0 of 103 patients)[15] to 3.5% (3 of 85 patients).[12]

Discussion

The main finding of the present review is that the endoscopic release of the cubital tunnel is effective for management of CuTS (Table 3). Compared with traditional open procedures, in this technique, the skin incision is smaller, and the dissection of soft tissues is minimal, with decreased risk of vascular insults to the nerve and significantly better cosmetic appearance of the scar. Moreover, the endoscopic approach allows to better visualize the site of entrapment, proximal and distal, without extensive dissection.[17] Some authors emphasize the presence of additional sites of compression far away from the skin incision.[7]

A study reported markedly lower resolution of preoperative pain in women (67%) than in men (94%).[22]

Regarding the negative association between the severity of the compression (Dellon's or McGowan's classification) and reported outcomes, a severe compression results in poorer outcomes. Ulnar nerve instability is frequently considered a contraindication to simple decompression because of a theoretical risk for neuritis and consequent pain, and requires surgical anterior transposition. Preoperatively, many authors excluded patients with nerve subluxation or 'flat sulcus'. On the other hand, at surgery, some authors have preferred to convert the procedure in an open anterior transposition. One study, in which postoperative satisfaction and pain were not influenced by preoperative nerve subluxation,[19] showed that nerve instability alone, without any neuritis, does not require anterior transposition. However, further studies would investigate this relationship.

When performing an open cubital release, an injury to the medial branch of the antebrachial cutaneous nerve may cause prolonged scar pain and hypesthesia.[34–36] These complications are not frequent in endoscopic surgery as small incisions and limited dissections minimize the risk of nerve injury.[12,18,21]

A main contraindication to the endoscopic approach is that late bleeding vessels are not visible at the time of surgery. Therefore, a hematoma may develop and require further surgery. Return to work is shorter[12,21]: most of the patients return to their activity within 7–15 days after the operation.[27] Only one study did not find any difference of return to work comparing endoscopic and standard procedures.[19]

Only one study[22] assessed the economic features, suggesting that shorter time of recovery and surgery would justify the increased costs of endoscopy. In one study,[17] most of patients had returned to moderate working activities within 8 days and to all activities in 55 days, probably because most of these patients had received worker compensations.

Regarding recurrence rates, one study reported comparable recurrences after endoscopic and standard release.[14] In two studies,[37,38] the nerve was transposed endoscopically: the necessity of this step is still controversial.[20]

The literature pertinent to endoscopic cubital tunnel release is clearly lacking and anecdotal in the evaluation of the learning curve: one study[7] assess that 'the learning curve is relatively short', and another study[17] declares that 'the learning curve is less steep than endoscopic carpal tunnel'. One study[27] suggests that trainees can learn the procedure quickly during the early phase of their training.

The Coleman scoring allowed to detect several areas of deficiencies. Regarding the study design, none of the selected studies were randomized controlled trials, and only 3 studies[18,20,22] were prospective cohort studies; the remaining 18 studies were case series or retrospective cohort studies. Only one study had a follow-up longer than 5 years.[15] Another deficiency was found in the outcome assessment: the investigator should be independent of the surgeons, and a written form would be the best method to eliminate the investigator's influence. The perfect study is a randomized control trial, but it is difficult to obtain in clinical practice, and in the future studies should at least be prospective cohort studies. A longer follow-up is needed.

The present investigation has several limitations: we grouped together endoscopic techniques, which used different devices, and performed different release of the surrounding constricting structures. However, there is no standard method of endoscopic cubital tunnel release, and each surgeon usually prefers the approach[21] which he/she is most familiar with.

Our belief is that endoscopic release of cubital tunnel is safe and effective. The technique does not provide better subjective and objective outcomes compared with open release, but the shorter time to return to work and the cosmetic appearance of the scar can be considered advantaged of this technique.

Conflict of Interest statement

The authors have no potential conflicts of interest.

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