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Trends in the Surgical Treatment for Cubital Tunnel Syndrome: A Survey of Members of the American Society for Surgery of the Hand

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Abstract

Background: Cubital tunnel syndrome is the second most common compression neuropathy affecting the upper extremity. The aim of this study was to determine the preferred surgical treatment for cubital tunnel syndrome by members of the American Society for Surgery of the Hand (ASSH). **Methods:** We invited members of the ASSH research mailing list to complete our online survey. They were presented with 6 hypothetical cases and asked to choose their preferred treatment from the following options: open in situ decompression, endoscopic decompression, submuscular transposition, subcutaneous transposition, medial epicondylectomy, and conservative management. This was assessed independently and anonymously through an online survey (SurveyMonkey). **Results:** 1069 responses were received. Seventy-three percent of the respondents preferred to continue conservative management when a patient presented with occasional paresthesias for greater than 6 months with a normal electromyogram (EMG) or nerve conduction velocity (NCV). Sixty-five percent picked open in situ decompression if paresthesias, weakness of intrinsics, and EMG/NCV reports of mild to moderate ulnar nerve entrapment was present. More than 50% of respondents picked open in situ decompression, as their preferred treatment when sensory loss of two-point discrimination of less than 5 or more than 10 was present in addition to the findings mentioned above. Seventy-nine percent of the respondents said their treatment algorithm would change if ulnar nerve subluxation was present. **Conclusions:** Our survey results indicate that open in situ decompression is the preferred operative procedure, if there is no ulnar nerve subluxation, among hand surgeons for cubital tunnel syndrome.

Keywords: cubital tunnel syndrome, in situ decompression, subcutaneous transposition, submuscular transposition

Introduction

Cubital tunnel syndrome (CuTS) is the second most common compression neuropathy affecting the upper extremity.[27] It may cause significant discomfort and disability for the patient and, in more severe cases, loss of function in the affected hand.[7] Treatment options for CuTS include nonoperative interventions and a broad range of surgical procedures such as open in situ decompression, endoscopic decompression, subcutaneous transposition, submuscular transposition, intramuscular transposition, and medial epicondylectomy.[27] Although this compression neuropathy has been treated surgically for over a hundred years, the best treatment still remains a matter of debate.[9] Choice of treatment is usually based upon severity of nerve compression, surgeon preference, and nonspecific patient factors.[3,9,19,23] Research studies have also been inconclusive on the optimal treatment for CuTS, with comparable outcomes for both decompression and anterior transposition.[17,36] The purpose of our study was to determine the preferred surgical treatment, by members of the American Society for Surgery of the Hand (ASSH), based upon patient scenarios with varying degrees of severity of CuTS.

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Materials and Methods

An email invitation was sent to members on the ASSH Research Mailing List. The email included a link to our online survey, SurveyMonkey (www.surveymonkey.com). The survey was designed by 5 hand surgeons with Certificates of Added Qualification and consisted of 6 patient scenarios describing varying degrees of severity of CuTS and 2 other questions (Table 1). The respondents had to choose their preferred treatment for each of the cases from the following options: open in situ decompression, endoscopic decompression, submuscular transposition, subcutaneous transposition, medial epicondylectomy, or, continue conservative management. There were also 2 independent questions that asked whether treatment algorithm would change based on age of the patient or ulnar nerve subluxation. Each respondent was allowed to complete the survey only once, and all responses were anonymously collected and tallied by the online survey program.

Results

At the time when we sent out the survey, there were 3000 active members (hand surgeons) on the ASSH Research Mailing List, and 357 members opted out of receiving the survey. In total, 1069 surgeons (40%) completed our survey. In all, 81% were orthopedic hand surgeons, and 41% of the respondents stated they have been practicing for more than 20 years. All questions were specific to the patient case scenarios.

When presented with the case of a patient with occasional paresthesias of the ring and small fingers for 6 months without any demonstrable weakness, positive Tinel sign, and normal electromyogram (EMG) or nerve conduction velocity (NCV), 73% of the surgeons said their preferred treatment would be to continue conservative management. Only 18% stated that they would perform open in situ decompression. When a patient presented with obvious weakness of the intrinsic musculature and EMG/NCV reports of mild to moderate ulnar nerve entrapment at the elbow, 65% picked open in situ decompression and 14% picked subcutaneous transposition as their preferred treatment.

In the more severe case of a patient presenting with constant paresthesias for greater than 6 months along with profound weakness and atrophy of the interosseous muscles, a sensory deficit with 2-point discrimination (TPD) of 5 mm, and EMG/NCV findings of moderate ulnar nerve entrapment, 55% of the respondents picked in situ decompression, 20% picked subcutaneous transposition, and 17% picked submuscular transposition as their preferred treatment. When the patient presented with all of the above and included significant medical comorbidities (coronary artery disease [CAD], chronic kidney disease [CKD], and uncontrolled diabetes mellitus [DM]), the trends in preferred treatment were similar (58% for in situ decompression, 18% for subcutaneous transposition, and 11% for submuscular transposition) except responses for conservative management increased from 0% in the previous case to 5%.

The most severe CuTS cases presented with numbness of the ring and small fingers for more than a year with interosseous atrophy and profound weakness. The patient also had a loss of TPD greater than 1 cm, and EMG/NCV showed severe ulnar nerve entrapment at the elbow. For this case, 51% of respondents picked in situ decompression, 22% picked subcutaneous transposition, and 19% picked submuscular decompression as their preferred treatment. When a patient presented with all of the above in addition to medical comorbidities such as CAD, CKD, and DM, 51% picked in situ decompression and 21% said they would continue conservative management. Only 13% picked subcutaneous transposition for that case. Medial epicondylectomy and endoscopic decompression were the least preferred treatments. The responses are summarized in Table 2.

In addition to the 6 cases, we asked 2 questions regarding change in treatment algorithm based on ulnar nerve subluxation and patient age. In all, 79% of the respondents said that their preferred treatment would change with subluxation of the ulnar nerve. In all, 81% of the respondents said that the age of the patient would not be a factor in changing their preferred treatment.

Discussion

It is widely accepted that simple decompression and anterior transposition (subcutaneous or submuscular) are the mainstream surgical treatments for CuTS. However, data in current literature are inconclusive on the optimal surgical treatment.[4] In 2008, Novak and Mackinnon investigated the primary operative procedures that are performed by hand surgeons for the treatment of CuTS.[23] Although their survey design did not involve patient scenarios, they determined factors that influence the surgeon's decision to operate. In their study, 133 of 164 respondents said they would use more than 1 operative procedure. However, 21 of 164 surgeons said that they would use a single procedure, subcutaneous transposition. In our survey, the majority of the surgeons selected in situ decompression as their preferred treatment.

There was only 1 case scenario in which the majority of respondents chose conservative management (73%). As this case involved no weakness or atrophy of the interosseous muscles, and EMG/NCV were normal, most surgeons would agree that there is no indication for operative treatment [4,9,15,30] In all, 18% of respondents selected open in situ decompression as their preferred treatment for that case. A study by Roberts et al showed that patients with normal NCV can still benefit from ulnar nerve decompression for their symptoms.[28] In a study by Padua et al, half of their patients who

Table 1. Survey Questions.

1. Your patient presents with mild occasional paresthesias of the ring and small fingers with subjective weakness for greater than 6 months. Tinel sign and elbow flexion test are positive. The patient has no demonstrable weakness. EMG/NCV and sensory exam are normal. What is your preferred treatment?
   - Open in situ decompression
   - Endoscopic decompression
   - Submuscular transposition
   - Subcutaneous transposition
   - Medial epicondylectomy
   - Continue conservative management and activity modification
2. Your patient presents with moderate paresthesias and sensory deficits of the ring and small fingers for greater than 6 months. There is obvious weakness of the extrinsic musculature. Tinel sign and elbow flexion test are positive. EMG/NCV reports mild to moderate ulnar nerve entrapment at the elbow. What is your preferred treatment?
   - Open in situ decompression
   - Endoscopic decompression
   - Submuscular transposition
   - Subcutaneous transposition
   - Medial epicondylectomy
   - Continue conservative management and activity modification
3. Your patient presents with severe constant paresthesias and sensory deficits of the ring and small fingers for greater than 6 months. Sensory deficit with TPD of 5 mm is present. There is interosseous muscle atrophy with profound weakness. Tinel sign and elbow flexion test are positive. EMG/NCV shows moderate ulnar nerve entrapment at the elbow. What is your preferred treatment?
   - Open in situ decompression
   - Endoscopic decompression
   - Submuscular transposition
   - Subcutaneous transposition
   - Medial epicondylectomy
   - Continue conservative management and activity modification
4. Your patient presents with severe constant paresthesias and sensory deficits of the ring and small fingers for greater than 6 months. Sensory deficit with TPD of 5 mm is present. There is interosseous muscle atrophy with profound weakness. Tinel sign and elbow flexion test are positive. EMG/NCV shows moderate ulnar nerve entrapment at the elbow. In addition, the patient has significant medical comorbidities including CAD, CKD, and uncontrolled DM. What is your preferred treatment?
   - Open in situ decompression
   - Endoscopic decompression
   - Submuscular transposition
   - Subcutaneous transposition
   - Medial epicondylectomy
   - Continue conservative management and activity modification
5. Your patient presents with severe constant paresthesias and sensory deficits of the ring and small fingers for greater than 1 year. Sensory deficit with TPD of >10 mm is present. There is interosseous muscle atrophy with profound weakness. Tinel sign and elbow flexion test are positive. EMG/NCV suggests severe ulnar nerve entrapment at the elbow with positive waves and fibrillations. What is your preferred treatment?
   - Open in situ decompression
   - Endoscopic decompression
   - Submuscular transposition
   - Subcutaneous transposition
   - Medial epicondylectomy
   - Continue conservative management and activity modification
6. Your patient presents with severe constant paresthesias and sensory deficits of the ring and small fingers for greater than 1 year. Sensory deficit with TPD of >10 mm is present. There is interosseous muscle atrophy with profound weakness. Tinel sign and elbow flexion test are positive. EMG/NCV suggests severe ulnar nerve entrapment at the elbow with positive waves and fibrillations. In addition, the patient has significant medical comorbidities including CAD, CKD, and uncontrolled DM. What is your preferred treatment?
   - Open in situ decompression
   - Endoscopic decompression
   - Submuscular transposition
   - Subcutaneous transposition
   - Medial epicondylectomy
   - Continue conservative management and activity modification
7. Will your treatment algorithm change with age?
   - Yes
   - No
8. Will your treatment algorithm change if ulnar nerve subluxation is present?
   - Yes
   - No

Note. EMG = electromyogram; NCV = nerve conduction velocity; TPD = 2-point discrimination; CAD = coronary artery disease; CKD = chronic kidney disease; DM = diabetes mellitus.

declined surgery for CuTS had improvement in their symptoms.[26] Dellon et al followed 121 patients who were initially treated conservatively. In all, 42% of the patients with intermittent paresthesias were symptom free after 6 months and 21% of those with mild symptoms needed surgery within 6 years.[10] For severe ulnar nerve compression, interosseous atrophy, and additional comorbidities, 7% of surgeons preferred conservative management in our study.

Table 2. Survey Responses to Patient Case Scenarios.

	Open in situ decompression	Endoscopic decompression	Submuscular transposition	Subcutaneous transposition	Medial epicondylectomy	Conservative management
Case	%	%	%	%	%	%
1	18	3	2	4	0	73
2	65	7	9	14	2	4
3	55	6	17	20	2	0
4	58	6	11	18	2	5
5	51	5	19	21	3	0
6	51	5	13	20	3	7

For 5 out of 6 patient case scenarios in our study, surgeons picked in situ decompression as their preferred treatment for CuTS. This operative technique has been proposed by many authors.[4,17,23,26] The advantages of this procedure include less surgical dissection, which lowers the risk of ulnar nerve devascularization,[13,24,25,36] and a faster recovery time.[13] Goldfarb et al performed in situ decompression on 69 limbs, and only 5 (7%) had persistent symptoms that were treated successfully with anterior transposition.[13] Cho and his colleagues reported 93% good or excellent outcomes in their patients treated with in situ decompression without any complications, recurrences, or ulnar nerve subluxations.[6] In a study by Nathan et al, 74 patients with CuTS underwent in situ decompression and had improvement of symptoms.[22] A systematic review of nonrandomized studies by Bartels et al showed simple ulnar nerve decompression to have the best results.[3]

Krogue et al looked into causes of revision surgery after in situ decompression and found that age, sex, body mass index (BMI), tobacco use, and DM were not associated with requiring a revision. However, prior elbow fracture or dislocation was a predictor of requiring a revision surgery after in situ decompression.[16] A more recent study by Zhang et al looked into rates of complications and secondary surgeries after in situ decompression versus transposition and found that although complication rates were low for both procedures, rate of secondary surgeries was higher with transposition (11% vs 2.5%).[34] This study also noted that complications were greater in patients with CKD, and secondary surgery rates were higher in patients with prior elbow trauma.[34]

Current literature shows favorable outcomes for endoscopic decompression. Chimenti and Hammert found studies that have reported 70% to 94% good to excellent results in those patients who underwent this procedure.[5] Complications included a 30% rate of postoperative hematoma.[5,11,14,31,33] Watts and Bain prospectively collected patient-reported outcomes and showed a trend toward improved satisfaction in the endoscopic versus the open decompression group.[32] A cadaveric study by Mirza et al illustrated the advantage of endoscopic visualization, due to high degree of anatomic variability, in allowing surgeons to minimize surgical trauma.[18] In our study, very few (3%-7%) respondents selected endoscopic decompression. This was higher, however, than the number who chose medial epicondylectomy.

A 2013 study by Zimmerman et al reported good or excellent results in 89% of their patients who had submuscular transposition.[35] The meta-analysis by Macadam et al found no statistical difference, but rather a trend in improved clinical outcomes with anterior transposition as opposed to in situ decompression.[17] Proponents of anterior transposition argue that only this procedure would address the dynamic nerve compression at the elbow.[36] The results of the human cadaveric study by Gelberman et al conclude that neural traction caused by elbow flexion can only be relieved by transposition or by decompressing it through medial epicondylectomy.[12] Similarly, a cadaveric study by Dellon et al showed that only submuscular transposition reduced intraneural ulnar pressure.[8] Anterior transposition is also preferred in cases where there is narrowing of the cubital tunnel by the presence of bony spurs, synovial swelling, or in cases of recurrent nerve subluxation.[21] The results from our survey also support the latter point on ulnar nerve subluxation, as 79% of the surgeons stated that their treatment algorithm would change if this were present.

Although numerous studies have concluded that anterior transposition is preferred in more severe cases of CuTS,[8,9,12,21,36] the results of our study indicate otherwise. Even in the most severe cases of CuTS and with additional medical comorbidities, the majority of respondents preferred in situ decompression. Anterior transposition was never the most preferred treatment for any of our patient cases. When chosen, subcutaneous transposition seemed to be preferred over submuscular transposition for our study. There has been a fall in number of anterior transpositions being performed from 50% to 37% over the past 25 years.[29] This may be due to the increasing evidence showing no difference in clinical outcomes between the surgical

procedures. Proponents of the in situ decompression would also argue that anterior transposition comes with the possible risk of ulnar nerve devascularization due to the extensive dissection required.[4,24,25,36] Other advantages of simple decompression include shorter operative times, preservation of anatomic location of the nerve, and a shorter recovery time.[4,6] The majority of surgeons chose in situ decompression as their preferred treatment for all cases in which surgical intervention was indicated (cases 2-6). Bacle et al did a retrospective multicenter study in which they compared results of 4 surgical techniques: open/endoscopic in situ decompression and submuscular/subcutaneous transposition.[2] They showed that regardless of the surgical procedure utilized, 90% of their patients were cured or showed improvement. In their study population, there were 6 cases of recurrences at follow-up: 1 with simple decompression and 5 with submuscular transposition. There were no recurrences of symptoms or complications associated with subcutaneous transposition in their study.[2]

According to the literature, medial epicondylectomy has been shown to have successful outcomes for CuTS. This allows complete decompression of ulnar nerve and can be considered as a "mini-anterior transposition" without devascularizing the ulnar nerve.[6,20] However, several complications have been reported including tenderness, postoperative pain, flexor pronator weakness, and valgus instability.[6,20] Muermans and De Smet reported that postoperative residual pain was present in 21 of 51 patients treated with medial epicondylectomy.[20] Only 0% to 3% of the surgeons picked medial epicondylectomy in our survey.

A recent study by Adkinson et al showed that surgeon characteristics played a role in selection of treatment for CuTS.[1] In their study, almost 80% of the patients underwent in situ decompression. They found that surgeons with highest volume of CuTS cases were significantly more likely to use in situ decompression. In addition, over the 7 years of the study period, there was 26% increase in in situ decompression and a 27% decrease in anterior transposition.[1] Our survey results also showed in situ decompression to be the preferred treatment for 5 of 6 patient scenarios. However, this may be due to surgeon practice preferences alone.

The results of our research must be interpreted within the context of its design, and this study has many limitations. Despite 3 formal reminders and a 2-month time frame to complete the survey, the response rate from members of the ASSH was low (40%). In addition, we did not ask for any reasoning in support of their preferred treatment for each case. The 8-question format was designed to minimize strain on participants and encourage a greater degree of response, but this strategy also limited the amount of information that could be collected. The results of our study are not stratified by collated responses from individual surgeons. This would have helped in assessing whether the primary determinant of the treatment is surgeon preference or patient presentation. Future studies should aim to gather a higher number of responses from members of ASSH for a similar survey and seek explanations for their preferred treatment.

In summary, research data on the optimal surgical treatment for CuTS remain to be inconclusive. However, in situ decompression seems to be preferred due to excellent outcomes and a lower risk of complications compared with other procedures. Our study results indicate in situ decompression is the preferred treatment of the majority of the surgeons. The preference of the surgeon did not change with increasing severity of CuTS or with additional medical comorbidities.

Ethical Approval

This study was approved by our institutional review board.

Statement of Human and Animal Rights

The participants of this study were surgeon members of the American Society for Surgery of the Hand (ASSH). Their participation required completion of an online survey. No experimental procedures were carried out on the human subjects.

Statement of Informed Consent

Informed consent was obtained from all participants in this study.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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