

Selection of Operative Procedures for Cubital Tunnel Syndrome

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Received: 9 July 2008 / Accepted: 26 August 2008 / Published online: 19 September 2008
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Abstract The purpose of this study was to investigate the primary operative procedures that are performed by hand surgeons for cubital tunnel syndrome and their reported satisfaction with these procedures. The survey consisted of 22 questions regarding primary operative treatment of cubital tunnel syndrome and demographics and was sent by email to the 459 active members of the American Association for Hand Surgery. One hundred sixty-four surgeons completed the survey (36% response rate). The total sample included 154 hand surgeons (143 males, 11 females) who operated on cubital tunnel syndrome and the majority of surgeons were in private practice ($n=100$) followed by academic practice ($n=50$). The most prevalent factors that influence the decision to operate include evidence of muscle atrophy (84%), abnormal nerve conduction studies (51%), and failed non-operative treatment (49%). Most surgeons ($n=133$) reported using more than one operative procedure for their patients with cubital tunnel syndrome. Factors that influenced the operative procedure selected included the degree of nerve compression (60%), medical comorbidities (30%), patient's occupation (28%), and obesity (22%). Following carpal tunnel surgery, 88% of the surgeons were "very satisfied" with their patient outcome and following surgery for cubital tunnel syndrome, only 44% were "very satisfied" with their

patient outcome. Most surgeons use more than one operative procedure in their treatment of patients with cubital tunnel syndrome and the selection of the operative procedure is influenced by patient factors and surgeon preference.

Keywords Cubital tunnel syndrome · Surgery

Introduction

There are numerous operative procedures described for the treatment of cubital tunnel syndrome ranging from simple decompression, medial epicondylectomy to transposition of the ulnar nerve [2, 4, 7, 9, 12, 13, 14, 15, 16, 19, 21, 23, 24, 25, 26, 27, 29, 30, 31]. With each operative procedure, there have been reports of excellent patient outcome as well as postoperative complications [10, 11, 18, 28]. While some surgeons have advocated particular surgical procedures dependent upon the severity of nerve compression, the overall selection of the operative procedure for primary surgery appears to be dependent upon surgeon preference and a number of non-specific patient factors [5, 8, 20].

The purpose of this study was to investigate the primary operative procedures that are performed by hand surgeons for cubital tunnel syndrome and their reported satisfaction with these procedures.

Material and Methods

A letter of introduction and electronic copy of the survey were sent by email to 459 active members of the American Association for Hand Surgery. Non-respondents were subsequently sent a second email of the survey 2 weeks

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later. Consent to be included in the study was implied with completion and return of the questionnaire.

The survey consisted of 22 questions; six questions regarding demographics and 16 questions regarding the surgeons' management of cubital tunnel syndrome, including their primary operative intervention.

Data analyses were performed with Statistical Package for the Social Sciences (version 11.0 for Windows, SPSS Inc., Chicago, IL, USA). Means and standard deviations were calculated for continuous data and frequency counts for categorical data. Chi-square analysis was used to evaluate the relationship between reported "good results" and satisfaction with cubital tunnel surgery among surgeons who most frequently used an anterior transposition, medial epicondylectomy, or decompression.

Results

The survey was sent by email to 459 hand surgeons who are members of the American Association for Hand Surgery. There were 164 surgeons who responded to the survey (36% response rate). There were 10 respondents who indicated that they did not operate on patients with cubital tunnel syndrome. Therefore the total sample included 154 hand surgeons (143 males and 11 females) and 65 of the surgeons have been in practice more than 21 years. The surgical specialties included orthopedic ($n=78$), plastic ($n=66$), and general ($n=4$) surgery. One surgeon was specialized in both plastic and orthopedic surgery and in five cases the specialty was not indicated. The majority of surgeons were in private practice ($n=100$) followed by academic practice ($n=50$).

There were 79% of surgeons who indicated that they always refer patients with cubital tunnel syndrome for nerve conduction studies and/or electromyography prior to surgery and 12% refer most of these patients. The most frequent non-operative treatments were to advise patient to avoid unnecessary elbow flexion (82%), prescribe soft elbow pad (67%), recommend over the counter anti-inflammatory medication (41%), prescribe anti-inflammatory medications (31%), prescribe rigid elbow splint (30%), prescribe work restrictions (30%), and refer to physical and/

or occupational therapy (25%). Only 9% of surgeons prescribe neuropathic medications and only 3% prescribe narcotic medications. The most prevalent factors that influence the decision to operate (Table 1) include evidence of muscle atrophy (84%), abnormal nerve conduction studies (51%), failed non-operative treatment (49%), and severe pain (43%).

When asked to indicate which surgeries the surgeon performs for the treatment of cubital tunnel syndrome, most surgeons ($n=133$) selected more than one operative procedure (Table 2). Only 21 surgeons selected a single surgery and the most frequent single surgery was the subcutaneous anterior transposition (10 surgeons), followed by the simple decompression (three surgeons), Learmonth (three surgeons), and Z-plasty/submuscular/transmuscular transposition (three surgeons). When asked what factors influence the selection of primary operative procedure (Table 3), the selected factors included the degree of nerve compression (60%), medical comorbidities (30%) patient's occupation (28%), obesity (22%), workers' compensation/litigation involvement (8%), and "other" (40%). In patients with cubital tunnel syndrome, concomitant release of the ulnar nerve at Guyon's canal is never performed by 46% of surgeons.

In general, 61% of the respondents felt that the outcome following surgery for cubital tunnel syndrome is not as good as for carpal tunnel syndrome. With respect to their own patients, 88% of the surgeons were very satisfied with their patient outcome following carpal tunnel surgery and following surgery for cubital tunnel syndrome, there were 44% of surgeons who were very satisfied with their patient outcome. There were significantly more surgeons that used either an anterior transposition or a medial epicondylectomy as their most frequent surgery who reported good results of their patients ($p=0.05$) and who reported that they were very satisfied with their results ($p=0.02$) compared to decompression.

Discussion

There are numerous operative procedures used for the treatment of cubital tunnel syndrome and most surgeons use

Table 1 In your opinion, do these factors influence your decision to operate on patients with Cubital Tunnel Syndrome?

	Strongly disagree	Disagree	No influence	Agree	Strongly agree	Don't know
Abnormal nerve conduction studies	3 (2%)	2 (1%)	6 (4%)	63 (42%)	76 (51%)	0
Evidence of muscle atrophy	3 (2%)	0 (0%)	1 (1%)	20 (13%)	128 (84%)	0
Severe pain	3 (2%)	5 (3%)	26 (17%)	52 (34%)	66 (43%)	0
Failed non-operative treatment	0 (0%)	2 (1%)	12 (8%)	62 (41%)	75 (49%)	1 (1%)
Workers' compensation &/or litigation	17 (11%)	26 (17%)	91 (60%)	16 (11%)	1 (1%)	0
Patient less than 75 years of age	8 (5%)	11 (7%)	79 (52%)	47 (31%)	7 (5%)	0

Table 2 For primary surgery in patients with Cubital Tunnel Syndrome, in what percentage of patients do you perform the following operative procedures?

	100–76%	75–51%	50–26%	25–1%	None
Simple open decompression	20 (17%)	11 (9%)	8 (7%)	38 (33%)	39 (34%)
Endoscopic decompression	1 (1%)	1 (1%)	1 (1%)	0	81 (96%)
Medial epicondylectomy	10 (11%)	4 (4%)	1 (1%)	26 (28%)	53 (56%)
Intramuscular anterior transposition	6 (6%)	7 (7%)	7 (7%)	13 (14%)	63 (66%)
Subcutaneous anterior transposition	32 (27%)	12 (10%)	15 (13%)	31 (26%)	29 (24%)
Learmonth submuscular transposition	10 (11%)	6 (6%)	5 (5%)	23 (25%)	49 (53%)
Z-plasty/submuscular/transmuscular anterior transposition	11 (12%)	7 (7%)	7 (7%)	26 (27%)	44 (46%)
Other	1 (3%)	1 (3%)	0	1 (3%)	27 (90%)

more than one operative procedure and generally base their selection of the specific operative procedure on patient factors. The decision to operate appears to be strongly influenced by evidence of muscle atrophy, abnormal nerve conduction studies and failed non-operative treatment. However, the selection of the operative procedure depends on surgeon preference and patient factors, such as the degree of nerve compression, medical comorbidities, patient's occupation, and body mass index.

The outcome following surgical treatment of chronic nerve compression in the upper extremity is perceived by surgeons to be different between carpal tunnel and cubital tunnel syndrome. Surgeons report better patient outcome following carpal tunnel syndrome compared to cubital tunnel syndrome and the reasons for this difference may be related to a number of operative and patient factors. In general, there is one operation performed for the treatment of carpal tunnel syndrome, which is release of the transverse carpal ligament. Much of the controversy of the operative procedure for carpal tunnel syndrome is the method by which to release the ligament but most surgeons would agree that successful management of patients with carpal tunnel syndrome depends on complete release of the flexor retinaculum [1, 3, 6, 17, 22]. In contrast for cubital tunnel syndrome, there are numerous operative procedures that have been described for the treatment of cubital tunnel syndrome ranging from simple decompression, medial epicondylectomy to transposition of the ulnar nerve [2, 4, 7, 9, 12, 13, 14, 15, 16, 19, 21, 23, 24, 25, 26, 27, 29, 30, 31]. These procedures vary not only in surgical technique but also in the correction of the etiologic factors. If it is hypothesized that only direct compression within the cubital tunnel or at the leading edge of the flexor carpi ulnaris muscle is responsible for the compression on the ulnar nerve then a simple decompression of all of the compressive bands may be sufficient to decompress the nerve. If however, the cubital tunnel syndrome is also a result of tension on the nerve or subluxation of the nerve over the medial epicondyle, then it would appear that a more "complex" approach may be necessary, including transposition to remove the stresses

associated with elbow flexion. The results of this survey suggest that most surgeons utilize more than one procedure for the primary operative treatment of cubital tunnel syndrome.

The essential goal with any operative procedure for cubital tunnel syndrome is to correct the etiologic factors that are contributing to nerve compression on the ulnar nerve at the cubital tunnel, which include to remove the compressive bands (including Osborne's band), to correct subluxation of the ulnar nerve and to decrease tension on the ulnar nerve. Correction of most of these factors may be successful with any of the operative procedures or postoperatively may result in no change in patient symptoms or in new symptoms following surgery. Care must be taken to avoid injury to the medial antebrachial cutaneous nerve and to avoid creating new compression sites by not fully releasing the ulnar nerve or by kinking the nerve at the proximal or distal points of the anterior transposition [18].

The reasons for failure to achieve a satisfactory result following cubital tunnel surgery are multifactorial and may include the presence of other disease processes. Associated neuropathies or medical comorbidities as occur with diabetes, thyroid disease, cervical disk disease, upper motor neuron disease, or distal compression at the wrist or Guyon's canal, may preclude a good result and may mimic "cubital tunnel" symptoms or be associated with it. Differentiation of the various etiologies is frequently difficult even with expert

Table 3 What factors influence your selection of the primary operative procedure for Cubital Tunnel Syndrome?

	Number	Percentage
Degree of nerve compression (eg mild, moderate, severe)	86	60
Medical comorbidities	43	30
Obesity	32	22
Patient's occupation	41	28
Workers' compensation/litigation involvement	12	8
Other	57	40

imaging and electrodiagnostic studies. Thus failure to achieve recovery of ulnar nerve function or deterioration of ulnar nerve function following cubital tunnel surgery does not imply deviation from the standard of care.

In the past, we have debated the merits of one type of cubital tunnel surgery over another and now based on our experience with revision cubital tunnel surgery [18], we believe that all surgeries have the potential for the entire spectrum of recovery. Enthusiastic “debates” regarding the “best” operation have focused surgeons’ attention on what occurs at the medial epicondyle (release, removal, transposition) and diverted attention away from what we believe is most important, ensuring that all compression has been taken off of the nerve and no new points of compression have been created. If as much attention was given to discussing techniques that would not create new areas of compression as has been given to discussing the status of the nerve with respect to the medial epicondyle, surgeon and patient satisfaction would likely increase. While there has been discussion about the medial intermuscular septum as a source of new compression with transposition, little attention has been paid to preventing distal entrapment by the fascial septum between the median and ulnar innervated muscles or preventing compression by either too tight a sling at the transposition site or with a standard Learmonth (compression of the nerve by the fascial bands within the flexor/pronator muscle mass). There can be a proximal band between the triceps and intermuscular septum that can kink the nerve very proximally [32]. To ensure that there is no new entrapment point or kinking of the nerve, it is recommended that at the conclusion of the procedure the surgeon runs a finger well proximally and distally to ensure no new compression sites. Finally, early postoperative mobilization is essential to encourage neural gliding and to decrease scar adhesions.

Most surgeons use on more than one operative procedure in their treatment of patients with cubital tunnel syndrome and the selection of the operative procedure is influenced by patient factors, including degree of compression, medical comorbidities, patient occupation, and obesity. Satisfaction following operative treatment for cubital tunnel syndrome is not as high as satisfaction following decompression of the carpal tunnel and the reasons for this difference remain to be investigated.

Acknowledgement The authors would like to thank Alice Romano from the AAHS central office for her assistance with the data collection and the members of the AAHS who completed the survey.

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