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Predictors of surgical revision after in situ decompression of the ulnar nerve

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Background: This study was performed to identify factors associated with the need for revision surgery after in situ decompression of the ulnar nerve for cubital tunnel syndrome.

Methods: This case-control investigation examined all patients treated at one institution with open in situ decompression for cubital tunnel syndrome between 2006 and 2011. The case patients were 44 failed decompressions that required revision, and the controls were 79 randomly selected patients treated with a single operation. Demographic data and disease-specific data were extracted from the medical records. The rate of revision surgery after in situ decompression was determined from our 5-year experience. A multivariate logistic regression model was used based on univariate testing to determine predictors of revision cubital tunnel surgery.

Results: Revision surgery was required in 19% (44 of 231) of all in situ decompressions performed during the study period. Predictors of revision surgery included a history of elbow fracture or dislocation (odds ratio [OR], 7.1) and McGowan stage I disease (OR, 3.2). Concurrent surgery with in situ decompression was protective against revision surgery (OR, 0.19).

Discussion: The rate of revision cubital tunnel surgery after in situ nerve decompression should be weighed against the benefits of a less invasive procedure compared with transposition. When considering in situ ulnar nerve decompression, prior elbow fracture as well as patients requesting surgery for mild clinically graded disease should be viewed as risk factors for revision surgery. Patient factors often considered relevant to surgical outcomes, including age, sex, body mass index, tobacco use, and diabetes status, were not associated with a greater likelihood of revision cubital tunnel surgery.

Level of evidence: Level III, Case Control Design, Treatment Study.

Keywords: Ulnar nerve; decompression; failure; surgical revision

Ulnar nerve compression at the elbow, or cubital tunnel syndrome (CuTS), is the second most common compression neuropathy in the upper limb after carpal tunnel syndrome.[36] At present, a variety of surgical techniques are available to treat CuTS, including in situ decompression, medial epicondylectomy, and anterior transposition (subcutaneous, intramuscular, submuscular).[3] Despite the range of techniques available, there is little consensus about

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which surgical technique is most effective in preventing failure.[10,13,28,42] However, in situ decompression has gained in popularity as proponents tout the ability of this minimally invasive procedure to maximize recovery, minimize complications, and minimize cost.[11,33,37]

No reliable predictors of surgical outcome after cubital tunnel surgery have been identified.[36] The lack of reliable, reproducible, and universally accepted outcome measures for CuTS has made identification of such factors difficult.[27] Studies have examined a variety of potential predictors, including (1) age, (2) duration of symptoms, (3) preoperative severity, (4) type of surgery, (5) electrodiagnostic data, and (6) provocative signs.[1,2,4,6,7,9,10,12,15-19,21-23,25,26,29,31,32,34,35,40,41] However, Shi et al,[36] the authors of a 2011 systematic review of studies of the predictors of surgical outcomes after anterior transposition "were unable to conclude which predictor(s) affect surgical outcomes" because of conflicting results. They included all prognostic papers published in the previous 30 years and found that most were underpowered and failed to address appropriate confounders, recommending that further rigorous study was warranted.

The purpose of this investigation was to retrospectively identify predictors of failure of in situ ulnar nerve decompression, defined as progression to subsequent revision surgery. Our a priori working hypothesis was that factors associated with more advanced disease (ie, greater slowing in ulnar nerve conduction velocity, longer duration of symptoms) would predict the need for revision ulnar nerve surgery after in situ decompression. The null hypothesis was that all demographic factors and disease-specific factors would be similar between those patients returning for revision cubital tunnel surgery and those who were treated successfully with a single primary surgery.

Materials and methods

A total of 444 patients were identified through a departmental electronic billing database search for Current Procedural Terminology (American Medical Association, Chicago, IL, USA) code 26718 (surgery on ulnar nerve at elbow) between January 2006 and July 2011. Of these, 231 patients were eligible for this study because they had undergone a primary in situ decompression (and possibly subsequent revision) surgery for CuTS by 1 of 5 hand fellowship-trained surgeons at a tertiary institution during the specified time period.

To establish our case cohort, we identified all patients who required revision cubital tunnel surgery after in situ ulnar nerve decompression. At our institution, the decision whether to proceed with revision surgery is a shared decision-making process between the patient and the treating surgeon. The indication for revision surgery in each case was persistent clinical symptoms deemed unacceptable by the patient. Potential predictor data (eg, race, sex, comorbidities, tobacco use, body mass index, age, symptom duration) were collected from each patient's record from the time of his or her primary surgery. Exclusion criteria established a priori included (1) lack of reliable records with which to characterize the primary surgery, (2) prior traumatic laceration of the ulnar nerve, (3) index operative procedures that decompressed or transposed the ulnar nerve for reasons other than CuTS (eg, elbow arthroplasty, distal humeral fracture), and (4) incomplete relief of symptoms that were offered revision surgery but chose not to pursue revision. The final case group comprised 44 elbows in 39 patients who underwent revision surgery.

The control cohort consisted of patients who underwent primary in situ decompression for CuTS by the same surgeons during the same interval without the need for subsequent revision. Patients were excluded from the control group after screening if they had continued symptoms after their primary surgery that warranted repeat nerve conduction testing or were offered revision surgery. Patients were also excluded as controls, despite successful ulnar nerve surgery, if they had undergone CuTS surgery requiring revision on their contralateral elbow due to the crossover of demographic data that would occur between groups if that were allowed. A group from the pool of eligible patients was randomly selected as controls by the first author, using a random-number generator to choose a patient record number, to reach approximately a 2:1 ratio to revision cases. The final control group totalled 79 elbows in 75 patients from a pool of 231 surgeries.

Data collection and statistical analysis

Descriptive statistics were produced to describe overall rates of revision among all in situ decompressions performed during the time interval of study data collection, to characterize the time to and reason for revision surgery, and to define the prevalence of bilateral symptoms in each patient group.

Bivariate analysis was performed on all variables collected, testing for statistical significance with the Student t test or Mann-Whitney U test for continuous independent variables and the χ^2 or exact testing for categoric variables. Nerve conduction velocity was analyzed as a continuous variable and as a categoric variable (normal vs abnormal) to minimize the effect of the range of normal values while allowing for consideration of the magnitude of slowing. Patients with bilateral disease contributed only a single entry to all patient-level data. Patient-level data were factors that were constant between operations in patients who received staged bilateral surgery.

Variables that were statistically associated ($P \leq .20$) with the need for revision CuTS surgery on bivariate testing were included in a multivariate binary logistic regression analysis in a forward stepwise manner. Odds ratios (ORs) with 95% confidence intervals (95% CIs) were determined for all significant predictors. Model fit was confirmed with the Hosmer-Lemeshow test. After multivariate modeling, qualitative analysis was performed to determine if rates of complete symptomatic relief after surgery differed according to disease stage. On the basis of the fixed number of 44 revision surgeries available for study, our multivariable modeling was powered for a maximum of 4 to 5 independent predictors.

Results

Revision surgery was required in 19% (44 of 231) of all in situ decompressions performed during the study period. The median time between the primary and revision surgery