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ORIGINAL ARTICLE

Three or more preoperative injections is the most significant risk factor for revision surgery after operative treatment of lateral epicondylitis: an analysis of 3863 patients

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Background: This study was conducted to identify the rate of failure of operative treatment of lateral epicondylitis, defined as progression to ipsilateral revision surgery, and associated patient-specific risk factors for failure.

Methods: A national database was used to identify patients undergoing surgical treatment of lateral epicondylitis from 2005 to 2012. Patients undergoing concomitant procedures were excluded. Patients who then required subsequent ipsilateral extensor carpi radialis brevis débridement or release within 2 years were identified using similar methods. A multivariate binomial logistic regression analysis was used to evaluate patient-related risk factors for revision surgery. In addition, the number of preoperative injections (1, 2, or ≥3) in the ipsilateral elbow was identified and included in the regression analysis. Adjusted odds ratios (OR) and 95% confidence intervals were calculated for each risk factor.

Results: Of 3863 patients who underwent operative treatment of lateral epicondylitis, 58 (1.5%) required ipsilateral revision surgery. Risk factors for revision surgery included age <65 years (OR, 2.95; $P = .003$), male gender (OR, 1.53; $P = .017$), morbid obesity (OR, 2.13; $P = .002$), tobacco use (OR, 1.87; $P < .001$), and inflammatory arthritis (OR, 1.79; $P = .009$). Having ≥3 ipsilateral preoperative injections was the most significant risk factor (OR, 3.55; $P < .001$), whereas having 2 (OR, 1.44; $P = .135$) or 1 (OR, 1.15; $P = .495$) was not significant.

Conclusions: The incidence of failure requiring revision surgery for lateral epicondylitis in the studied population is low (1.5%). Risk factors for revision surgery include younger age, male gender, morbid obesity, tobacco use, and inflammatory arthritis. The most significant risk factor for revision surgery is having ≥3 ipsilateral preoperative injections.

Level of evidence: Level IV; Case Series from Large Database; Treatment Study

Keywords: lateral epicondylitis; tendinopathy; surgery; risk factor; treatment; tennis elbow

The University of Virginia Institutional Review Board for Health Sciences Research exempted this study from review because the data used are publicly available and the subjects cannot be identified directly or through identifiers.

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Lateral epicondylitis is a common cause of elbow pain and is estimated to affect 1% to 3% of the adult population annually.[1,34,36] The condition is due to repetitive microtrauma that results in tendon degeneration and most commonly occurs between the fourth and sixth decades of life.[4,30,31,36] Thus, lateral epicondylitis is a common cause of occupational disability, with prevalence estimates of up to 15% among workers in repetitive hand task industries.[8,14,26,35,36] Although most patients with lateral epicondylitis experience symptom resolution after conservative treatments, such as physical therapy, corticosteroid injections, and bracing, these measures will fail in approximately 4% to 11% of these patients, and they will go on to require surgical intervention.[3,5-7,11,18,23,28,32,33]

The surgical treatment of lateral epicondylitis is highly effective, with multiple studies reporting greater than 85% good to excellent results.[2,9,13,25] Despite the high success rate of surgical management, recalcitrant lateral epicondylitis does occur, often times requiring revision surgery.[24] Given the low incidence of patients requiring initial surgical treatment for lateral epicondylitis and the high success rate associated with the index procedure, the incidence of revision surgery is ill-defined and limited to small, retrospective case series.[6,24] Furthermore, literature investigating risk factors for failure of surgical management of lateral epicondylitis is scarce and has been grossly underpowered because of small patient numbers. The present study used a national database to identify independent patient risk factors for failure of operative treatment of lateral epicondylitis requiring ispilateral revision surgery. We hypothesized that although the rate of revision surgery would be low, a number of patient-specific factors would be associated with an increased risk for revsion surgery.

Materials and methods

An insurance-based database of patient records, the PearlDiver Patient Records Database (www.pearldiverinc.com, Fort Wayne, IN, USA) was used for the present study. This database contains data from several different insurers, including Medicare and private insurers. The Medicare database was used for the present study because it includes an older patient demographic more likely to be afflicted with lateral epicondylitis and a larger number of patients so that a revision rate could be accurately calculated.

The PearlDiver database contains procedural volumes, basic patient demographics, prescription drug information, numerous other data for patients, International Classification of Diseases 9th Revision (ICD-9) diagnoses codes, and procedures or Current Procedural Terminology (CPT; American Medical Association, Chicago, IL, USA) codes. The database covers patients from the years 2005 to the second quarter of 2012, and patients can be tracked across all locations (inpatient, outpatient, etc) throughout the database years. Overall, the database contains approximately 100 million patients with orthopedic diagnoses. All data are deidentified and anonymous.

For the purposes of this study, we queried the full Medicare Standard Analytic Files from 2005 to 2012 for patients undergoing surgical treatment of lateral epicondylitis using CPT codes (24350, 24351, 24352, 24354, 24356, 24358, and 24359) and a corresponding ICD-9 code for a diagnosis of lateral epicondylitis (726.32). Private insurers were excluded from the analysis. Patients undergoing concomitant procedures were excluded to obtain a final study cohort of patients undergoing isolated extensor carpi radialis brevis (ECRB) débridement/release. Patients without a CPT modifier for laterality were also excluded. Patients with subsequent ipsilateral ECRB débridement or release were then identified using the same CPT code for the ipsilateral arm within the study period. We excluded patients who had alternate diagnoses, such as radial tunnel syndrome or lateral ulnar collateral ligament insufficiency, as their reason for revision surgery, focusing on recurrent lateral epicondylitis only. Only patients with a minimum of 2 years of follow-up were included.

A multivariate binomial logistic regression analysis was then used to evaluate the independent effect of numerous patient-related risk factors, including age, gender, low body mass index (BMI; <19 kg/m^2), obesity (BMI 30-40 kg/m^2), morbid obesity (BMI >40 kg/m^2), tobacco use, alcohol abuse, diabetes mellitus, inflammatory arthritis, hypercoagulable disorder, hyperlipidemia, hypertension, peripheral vascular disease, congestive heart failure, coronary artery disease, chronic lung disease, chronic liver disease, chronic kidney disease, chronic anemia, thyroid disease, and major depression.

In addition, the number of preoperative injections in the ipsilateral elbow was determined for each patient using CPT codes for injections associated with the lateral epicondylitis ICD-9 code. Unique groups of patients were then created with 1, 2, or ≥3 preoperative injections for lateral epicondylitis into the ipsilateral extremity. The number of ipsilateral preoperative injections was also factored into our binomial logistic regression analysis to determine its effect on revision surgery.

Adjusted odds ratios (OR) and 95% confidence intervals (CIs) were calculated for each risk factor. Trends over time were assessed with linear regression analysis, and results are reported with their corresponding R^2 and P values. For statistical tests, only P values <.05 were considered to represent statistical significance. SPSS 23 software (IBM, Armonk, NY, USA) was used for all statistical calculations.

Results

During the study period, 3863 patients met all inclusion and exclusion criteria, forming the final study cohort of patients who underwent isolated ECRB release for the treatment of lateral epicondylitis. Women comprised 57.2% (n = 2209) of the cohort, and men comprised 42.8% (n = 1654). The age distribution of patients is presented in Fig. 1, where 71.6% of patients were aged <65 years.

In total, 58 patients (1.5%) required ipsilateral revision surgery, at an average of 511 days (1.4 years) from the time of the index procedure. The annual rate of revision surgery is presented in Fig. 2, and this did not change significantly over time ($R^2 = 0.1284$, $P = .430$). Independent patient-related risk factors for revision surgery included age <65 years (OR, 2.95; $P = .003$), male gender (OR, 1.53; $P = .017$), morbid obesity (OR, 2.13; $P = .002$), tobacco use (OR, 1.87; $P < .001$), and inflammatory arthritis (OR, 1.79; $P = .009$, Table I). Several additional comorbidities did not affect reoperation rates, and these are presented in Table II.

Assessing the effect of preoperative injections, having ≥3 ipsilateral injections preoperatively was the most significant risk