Published in final edited form as:

*Am J Sports Med*. 2015 September ; 43(9): 2133–2137. doi:10.1177/0363546515590220.

# Factors Associated With Failure of Nonoperative Treatment in Lateral Epicondylitis

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## Abstract

**Background—**Lateral epicondylitis is a common cause of elbow pain that is treated with a variety of non-operative measures and often improves with time. There is minimal research on patients that fail those non-operative treatments.

**Purpose—**To identify baseline patient and disease factors associated with the failure of non-operative treatment of lateral epicondylitis, defined by surgery after a period of non-operative treatment..

**Methods—**We analyzed 580 patients treated for lateral epicondylitis at a tertiary center between 2007 and 2012. Disease-specific and patient demographic characteristics were compared between patient groups (**non-operative treatment versus surgical treatment**). A **multivariable** logistic regression model was created based on preliminary univariate testing to determine which characteristics were associated with failure of non-operative treatment.

**Results—**Ninety-two (16%) of the 580 patients **underwent surgical** treatment at a mean of 6 months (range, 0 to 31 months) from their initial visit at our center. Univariate analysis demonstrated a potential association ($p<0.10$) between operative management and the following factors at presentation to our center: increased age, **body mass index**, duration of symptoms, presence of radial tunnel syndrome, history of prior injection, physical therapy, splinting, smoking, workers' compensation, a labor occupation, **use of** narcotics, use of anti-depressant medications, and a history of previous orthopedic surgery. In the final **multivariable** model, a workers' compensation claim (OR **8.1**), prior injection (OR **5.6**), the presence of radial tunnel syndrome (OR **3.1**), history of previous orthopedic surgery (OR **3.2**), and duration of symptoms

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Level of Evidence: Prognostic-Level III

greater than 12 months (OR **2.5**) remained significant independent predictors of **surgical** treatment.

**Conclusion—**We have identified risk factors for **surgical** treatment for lateral epicondylitis. While these findings do not provide information regarding causal factors associated with surgery, these patient and disease-specific considerations may be helpful when counseling patients regarding treatment options and the likelihood of the success of continued non-operative treatment.

**Keywords**

epicondylitis; lateral; elbow; tennis; treatment

## Introduction

Lateral epicondylitis is a common cause of elbow pain, affecting 1% to 3% of the adult population each year.[22] The etiology of lateral epicondylitis is unknown, although a history of manual labor and repetitive activities often precedes the onset of the condition.[10] Rather than an inflammatory response, repetitive microtrauma to the ECRB tendon causes vascular hyperplasia and an accumulation of disorganized collagen, termed angiofibroblastic hyperplasia.[1] Lateral epicondylitis often improves with time, with approximately 80% of patients reporting resolution of symptoms within one year of diagnosis.[9, 19]

A variety of non-operative methods have been proposed as treatment including nonsteroidal anti-inflammatory medications, steroid injections and orthotic devices.[7, 20] Physicians often recommend physical therapy, activity modification, or periods of rest to promote healing. Despite these common treatment measures, there is not a standardized treatment protocol for lateral epicondylitis to mitigate symptoms, speed recovery, or promote healing. Surgical intervention for lateral epicondylitis is typically reserved for patients with persistent pain after 6 to 12 months of non-operative treatment.[19, 7, 4] Surgery entails debridement of the diseased tissue within the extensor carpi radialis brevis and occasionally the extensor digitorum communis through open or arthroscopic techniques. Various studies report improved postoperative symptoms in over 80% of patients.[16, 8]

While an extended non-operative treatment approach is well accepted, for those who ultimately require surgery, there is concern that they may have unnecessarily prolonged the period of pain and dysfunction while pursuing conservative modalities. The primary aim of this study was to identify factors associated with the failure of non-operative treatment of lateral epicondylitis. Our hypothesis was that both disease (i.e., increased symptom duration) and patient-specific factors (i.e., workers compensation coverage) would predict the failure of non-operative treatment. The null hypothesis was that all patient and disease factors occur with similar frequency in the non-operative success group compared with the non-operative failure group.

## Materials and Methods

This retrospective case control investigation was approved by our institutional review board. We identified all adult patients treated for lateral epicondylitis by ICD-9 code (726.32) at our tertiary care institution from 2007 to 2012. All patients aged 30 years or older with the diagnosis of lateral epicondylitis and without prior surgical treatment for lateral epicondylitis or radial tunnel syndrome were eligible for inclusion in the study. The diagnosis of lateral epicondylitis was confirmed during manual review of all medical records selected by ICD-9 code. All patients selected to contribute to data analysis were explicitly diagnosed with lateral epicondylitis by attending treating surgeons based on patient history and physical examination. Lateral epicondylitis was diagnosed by suggestive patient history and point tenderness at the origin of the extensor carpi radialis brevis from the lateral epicondyle. Radial tunnel syndrome was diagnosed on the criteria described previously by Verhaar and Spaans.[23] Affected patients had a suggestive patient history and pain in the proximal radial part of the forearm, which was aggravated by work but also present at rest. On examination, patients demonstrated point tenderness over the posterior interosseous nerve, with maximal tenderness elicited at the point where the nerve passes under the proximal edge of the supinator muscle, anterior and approximately five centimeters distal to the lateral epicondyle.

### Statistical methods

Descriptive statistics (frequencies for dichotomous variables) were used to characterize baseline characteristics. Univariate analysis was performed on all variables collected, testing for statistical significance with Student's *t*-test for continuous independent variables and chi-square or Fisher's exact test for categorical variables. **From the univariate analysis,** odds ratios were calculated for all categorical variables.

Variables that were associated with failure of non-operative treatment ($P < 0.1$) were entered into a multi**variable** logistic regression analysis, using a **backward**, step-wise method. Interaction terms were created to test for the possibility of effect modification between “affected arm” and “dominant arm”, and between all treatments occurring prior to presentation (prior injection, prior physical therapy, prior splinting). Model explanatory power was assessed using the Hosmer-Lemeshow goodness-of-fit statistical test. Statistical significance was set at the $\alpha$=0.05 level for all tests.

## Results

Six hundred and sixty-four patients were identified in our billing database and manual chart review excluded 84 patients who did not have lateral epicondylitis or had prior surgery for lateral epicondylitis. Therefore, 580 patients were included for analysis. Baseline patient characteristics and disease specific factors that were recorded are listed in Table 1. If a patient developed bilateral symptoms during their treatment, only the initial side was included in this analysis.

In our cohort of 580 patients, 92 (16%) **underwent** surgical treatment, leaving 488 non-operative controls for comparison.

### Baseline patient-specific characteristics

There were 242 males and 338 females included in our study population. Mean age was 47 years (SD 9.3 yrs, range 30-83 yrs). A majority of the patients were non-smokers (489, 84%), non-diabetic (533, 92%), married (404, 70%), and non-laborers (373, 64%). Fifty-three patients (9%) had their treatment paid for through the Office of Workers' Compensation Programs. Most patients did not use anti-anxiety (526, 91%), narcotic (504, 87%), or anti-depressant (469, 81%) medications. Almost half of our patients had a history of a prior orthopedic surgery (282, 49%). No patient presenting for treatment had a history of previous surgery for lateral epicondylitis.

### Baseline disease-specific characteristics

The mean duration of symptoms at presentation to our office was 8 months. At presentation to our practice, 122 patients (21%) had already been treated with physical therapy, 145 (25%) had been treated with a splint and 96 patients (17%) had been treated with an injection. Ninety-seven patients (17%) had concurrent ipsilateral radial tunnel syndrome, diagnosed by their treating surgeon in our practice at their initial visit.

### Multivariate Model

The final **multivariable regression** model included the following patient-specific factors that demonstrated a **potential** association with surgery during univariate analysis: Age, **body mass index** smoking, use of narcotics, **use of** anti-depressant medications, workers' compensation claim, a labor occupation, and history of previous orthopedic surgery (Table 1). Disease-specific factors that demonstrated a **potential** association with surgery during univariate analysis and were included in the final multivariate model included: Duration of symptoms >12 months, concomitant radial tunnel syndrome, prior injection, therapy, **and prior** splinting. An interaction term, which was created to evaluate the effect of handedness with laterality of symptoms and surgery, showed no effect. Interaction terms were also created to evaluate the possibility of significant correlation between variables related to prior treatment. Interactions between prior injection, prior therapy, and prior splinting were all found to be insignificant.

The final **multivariable regression model** identified the presence of radial tunnel syndrome, workers' compensation, previous injection, duration of symptoms greater than 12 months and history of previous orthopedic surgery as factors that remained independently predictive of failure of non-operative treatment (Table 2). The overall model was statistically significant (LR Chi-square=167.554, df=11, p=<.001). The Hosmer-Lemeshow lack of fit test (chi square 4.435, p=0.816) indicated acceptable model fit to the data.

## Discussion

Lateral epicondylitis is generally considered a self-limiting problem best treated with a course of non-operative treatment since most patients improve within one year.[19, 5] There is no standard non-operative regimen that has proven superiority, leading to considerable variation in non-operative treatment protocols.[1, 3] However, we theorized that there may be baseline patient and disease characteristics identified at the time of presentation to an orthopaedic surgeon that can be used to predict response to non-operative treatment. This information could be helpful when discussing expectations of symptom relief following non-operative treatment with patients.

In this study, 16% of patients underwent surgery. There are few studies that have reported on surgical rates for lateral epicondylitis. Nirschl and Pettrone reported that 7.2% of their cohort of 1213 eventually underwent surgery.[16] Coonrad and Hooper reported that 11.5% of their 339 patients failed conservative treatment and underwent surgery.[5] In comparison to the single center findings reported previously, Sanders et al. in a population based study reported that 3.2% of patients treated for lateral epicondylitis in Olmstead County, MN between 2009-2012 underwent surgery.[17] The differences in surgical rates likely reflect the differences in patient population, with a population based study likely having a higher proportion of mild cases than an upper extremity specialty practice. Our higher surgical rate likely reflects the fact that a large proportion of our patient population had sought treatment prior to presentation. The mean duration of symptoms for our entire cohort (both surgical and nonsurgical) was 8 months. Over 50% of our surgical group had failed a corticosteroid injection with another physician before seeking care in our presentation. For these reasons, the surgical rate reported in this study may lack widespread generalizability, though similar surgical rates may be expected in a similar tertiary care upper extremity referral center.

**In addition, there are** limited data in the literature to inform practitioners about the prognosis of treatment in patients with lateral epicondylitis. Haahr et al. showed that patients with a higher severity of pain and patients who were manual laborers had a worse prognosis at one year after diagnosis, regardless of non-operative treatment.[9] This contrasts with the findings of this study, as we did not find manual labor to be predictive of failure of non-operative treatment. Similar to the findings of Haahr et al., we found that gender, age, and increased **body mass index** were not prognostic of outcome at one year of follow-up. Other studies have shown factors such as smoking, repetitive upper extremity activity, and obesity to be risk factors for the development of lateral epicondylitis, but not necessarily associated with failed treatment.[18, 24]

Our model showed duration of symptoms greater than 12 months prior to presentation and presence of ipsilateral radial tunnel syndrome to be predictors of failure of non-operative treatment. Prolonged duration of symptoms may indicate a severe case of lateral epicondylitis less amenable to non-operative treatment. However, this may alternatively simply reflect that for most practitioners, 12 months of symptom duration is an indication for surgery. Concomitant radial tunnel syndrome is thought to contribute to the morbidity of chronic lateral epicondylitis and patients affected by both diagnoses have a worse outcome despite surgical treatment.[15, 11] Patients with concomitant radial tunnel syndrome may have a higher severity of lateral elbow symptoms and therefore fare worse with non-operative treatment, as our model suggests.

Consistent with previous studies in the hand surgery literature, a workers' compensation claim was a strong risk factor for failure of non-operative treatment.[12, 20] In our study, history of prior injection was predictive of failure of non-operative treatment. Injections, whether corticosteroid, autologous blood, prolotherapy, platelet-rich plasma or botulinum toxin, have not been shown to be more effective than placebo in treating lateral epicondylitis.[1, 20, 25, 14] Based on the data available, we cannot determine if corticosteroid injection prior to presentation was associated with eventual surgery because injection, regardless of when it is administered, impacts rates of eventual symptom recurrence. It is plausible that prior injection was a proxy for increased symptom severity, which may in turn portend a worse response to conservative treatment.

Psychological factors, such as depression, have previously been shown to influence outcome measures in upper extremity surgery.[13, 14] A previous study showed higher levels of anxiety and depression in patients with lateral epicondylitis compared with healthy controls.[2] In our study, the use of anti-depressants approached significance (p-value 0.069) in the univariate analysis but did not remain significant in the final multivariate model. It is possible that directly screening our patients for depression, rather than noting the use of antidepressive medications, would have demonstrated an influence on treatment of lateral epicondylitis as there may have been patients either undiagnosed or who are not being treated for their depression or anxiety with medications.

Patients with a history of prior orthopedic surgery were more likely to fail non-operative treatment in our model. To our knowledge, this is the first report demonstrating that a patient's history of prior orthopedic surgery is associated with increased odds of undergoing surgery for lateral epicondylitis. Patients who have undergone prior surgeries may be more likely to consider or want surgical intervention compared to a patient without any surgical history. As our study was not designed to establish the reasons for the observed associations, further study is needed.

A limitation of our study is the retrospective nature of our database. There may be confounding variables that were not collected or contained in the medical record. In particular, it is unknown how patient activity level may have affected patient response to non-operative treatment. In addition, we chose a minimum age of 30, which may have led to loss of important cohort information. We chose an age of 30 to minimize the possibility of including patients with an acute injury or acute tendinitis, both of which are distinct from the chronic, degenerative tendinosis that is a hallmark of tennis elbow. Also, there is a possibility that some patients followed up with another practice for surgery, which would detract from our ability to assess the effectiveness of conservative treatment. Surgery was chosen as a marker for failed non-operative treatment because it offered a clear, objective criterion on which to separate and compare groups. Nonetheless, we recognize that this definition does not preclude the possibility that some patients treated non-operatively may have had continued symptoms. The database also did not capture severity of lateral epicondylitis, which may be predictor of failure of non-operative treatment. We captured patients based on CPT code rather than uniform diagnostic criteria of lateral epicondylitis. Future prospective studies would benefit from better documentation of symptom severity and post-treatment symptom resolution through the use of validated patient outcome scores such as the Patient Rated Tennis Elbow Evaluation (PRTEE).

## Conclusion

The treatment for lateral epicondylitis can be long and frustrating for patients, especially since there is not a standard superior treatment. With these data, we now counsel our patients that while only 16% of patients ultimately need surgery, the risk of needing surgery to relieve symptoms is significantly higher among patients with concomitant radial tunnel syndrome, a prior injection, history of prior orthopedic surgery, or a workers' compensation claim.

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*What is known about this subject:* Lateral epicondylitis is a common and can be a nagging problem that in time typically resolves with non-operative measures. Little is known about the population of patients that fail these non-operative treatments.

*What this study adds to existing knowledge:* This study seeks to characterize the baseline factors associated with patients that fail non-operative treatments for lateral epicondylitis.

## Table 1

Patient Demographic Variables Included in the Analysis

| | Non-operative N = 488 n (%) | Operative N = 92 n (%) | p-value |
|---|---|---|---|
| Patient baseline characteristics: | | | |
| Age: 30-49 years | 259 (53) | 65 (71) | **.002** |
| 50-59 years | 165 (34) | 24 (26) | |
| 60+ years | 64 (13) | 3 (3) | |
| Age: Mean (SD) | 48.8 (10.0) | 45.3 (7.8) | **.001** |
| BMI 0-18.5 | 7 (1) | 1 (1) | 0.908 |
| 18.5-24.9 | 144 (30) | 27 (29) | |
| 25-29.9 | 180 (37) | 30 (33) | |
| 30-34.5 | 86 (18) | 19 (21) | |
| 35+ | 66 (14) | 14 (15) | |
| BMI: Mean (SD) | 28.1 (6.0) | 29.5 (7.4) | **0.1** |
| Diabetes- Yes | 41(8) | 6(7) | 0.549 |
| History of previous orthopedic surgery | 217 (44) | 65 (71) | **<0.001** |
| Workers' compensation claim | 25 (5) | 28 (30) | **<0.001** |
| Use of narcotics | 53 (11) | 23 (25) | **<0.001** |
| Occupation - labor | 49 (10) | 19 (21) | **0.012** |
| Smoking | 66 (14) | 19 (21) | **0.085** |
| Use of anti-depressant medication | 87 (18) | 24 (26) | **0.065** |
| Use of anti-anxiety medications | 42 (9) | 12 (13) | 0.179 |
| Sex: Male | 208 (43) | 34 (37) | 0.312 |
| Marriage status - married | 345 (71) | 59 (64) | 0.572 |
| Handedness - right | 394 (81) | 74 (80) | 0.783 |
| Disease specific characteristics: | | | |
| Prior injection | 49 (10) | 47 (51) | **<0.001** |
| Prior physical therapy | 82 (17) | 40 (43) | **<0.001** |
| Duration of symptoms > 12 months | 52 (11) | 38 (41) | **<0.001** |
| Prior splinting | 109 (22) | 36 (39) | **0.001** |
| Concomitant radial tunnel syndrome | 61 (13) | 36 (39) | **<0.001** |

**Table 2**

Baseline characteristics predictive of failure of non-operative treatment by multivariate analysis

| Risk Factor | Regression Coefficient, B | Wald Statistic (p-value) | Standard Error of B | Odds ratio (95% CI) |
|---|---|---|---|---|
| Workers' compensation claim | **2.086** | **25.2 (.000)** | **0.416** | **8.1 (3.6, 18.2)** |
| Prior injection | **1.716** | **20.1 (.000)** | **0.378** | **5.6 (2.7, 11.7)** |
| Radial tunnel syndrome | **1.119** | **10.3 (.001)** | **0.349** | **3.1 (1.5, 6.1)** |
| Prior orthopaedic surgery | **1.167** | **13.1 (.000)** | **0.323** | **3.2 (1.7, 6.1)** |
| Duration of symptoms > 12 mo | **0.897** | **4.0 (.045)** | **0.447** | **2.5 (1.0, 5.8)** |