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## Predictive value of magnetic resonance imaging in outcomes of nonsurgical treatment of lateral epicondylitis

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**Background:** The diagnosis of lateral epicondylitis is typically made on the basis of clinical history and examination. However, magnetic resonance imaging (MRI) is often used to supplement evaluation of the patient with a painful elbow and can identify extensor carpi radialis brevis (ECRB) tendon tears. The objective of this study was to determine if ECRB tear size on MRI could be used as a prognostic indicator for patients with recalcitrant lateral epicondylitis and partial ECRB tears.

**Methods:** Forty-one patients with recalcitrant lateral epicondylitis and a partial ECRB tear on MRI were identified (22 men and 19 women; age:  $49 \pm 8$  years; height:  $165 \pm 36$  mm; weight:  $73 \pm 18$  kg). Patients were divided into two groups based on whether they underwent surgery or not. Nonsurgical treatment was evaluated by the Disabilities of the Arm, Shoulder, and Hand questionnaire, and surgery was considered a failure of nonsurgical treatment. Nonsurgical treatment was variable and included a mixture of physical therapy, rest, injection therapy, and splinting.

**Results:** Of the 41 patients, 5 patients opted for immediate surgery and 36 patients were treated nonsurgically. Of those 36 patients, 11 patients had symptom relief, 19 patients had subsequent surgery, and 6 patients chose not to have surgery despite continued symptoms. Tear size on MRI did not differ significantly between the patients who had symptom relief with nonsurgical treatment and the other patients ( $7.7 \pm 4.3$  mm vs.  $9.7 \pm 2.5$  mm,  $P = .07$ ).

**Discussion:** Only 11 of 41 patients (27%) with recalcitrant lateral epicondylitis and ECRB tear had symptom relief with nonsurgical treatment. However, ECRB tendon defect size on MRI did not predict success or failure of nonsurgical treatment.

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Commonly known as “tennis elbow,” lateral epicondylitis is clinically defined by pain in the region of the epicondyle, which is provoked by resisted use of extensor muscles of the wrist.<sup>3</sup> The diagnosis of lateral epicondylitis is typically made on the basis of clinical history and examination, with magnetic resonance imaging (MRI) serving to provide a supplemental evaluation of the patient’s elbow. MRI can be useful to rule out other elbow pathologies and confirm the diagnosis of lateral epicondylitis. MRI in patients with recalcitrant lateral epicondylitis often reveals an extensor carpi radialis brevis (ECRB) tendon tear. However, it is not known if tear size on MRI is predictive of which patients will benefit from

nonsurgical treatment alone and which will ultimately require surgery.

A 2004 study aimed at evaluating treatment response in lateral epicondylitis by tracking changes on MRI found that 83% of patients had ECRB tears.<sup>7</sup> The study examined these changes at baseline and again at 6 weeks in 30 patients being treated with either wrist splint immobilization or corticosteroid injection.<sup>7</sup> The treatments resulted in symptomatic relief, despite no change in MRI findings.<sup>7</sup> This suggests that the presence of tear on MRI does not preclude symptom relief with nonsurgical treatment. Similarly, Walton et al (2011) assessed the relationship between MRI abnormalities of the ECRB tendon and a patient’s clinical assessments.<sup>11</sup> The study used an MRI scoring system to grade the degree of tendinosis and length of separation of the ECRB tendon from the lateral epicondyle in 21 patients diagnosed with chronic lateral epicondylitis.<sup>10</sup> Clinical symptoms were assessed using the Quick Disabilities of the Arm, Shoulder, and Hand (QuickDASH) and Upper Extremity Scale

Northwell Health, The Feinstein Institute for Medical Research Institutional Review Board, approved this study (IRB #: 17-0264).

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clinical measures.<sup>11</sup> Moderate-to-severe signal changes on MRI were found in 18 of the 21 subjects.<sup>11</sup> Paradoxically, larger tendon separation on MRI was associated with less disability based on QuickDASH scores.<sup>11</sup> An additional study found that 14 of 24 (58%) patients undergoing surgery for lateral epicondylitis had ECRB tendon defects.<sup>10</sup> However, 4 of 9 controls (individuals with MRIs to evaluate elbow problems unrelated to lateral epicondylitis) also had an ECRB tendon defect.<sup>10</sup> The authors concluded that the use of MRI in the management of patients with lateral epicondylitis merits further study.<sup>10</sup> Therefore, the purpose of the present study was to determine if tear size on MRI could be used as a prognostic indicator for patients with recalcitrant lateral epicondylitis and partial ECRB tears. We hypothesized that the defect or tear in the ECRB origin on MRI would not predict failure of nonsurgical treatment of lateral epicondylitis.

## Methods and materials

### Participants

Patients presenting to a single multisurgeon practice were included in this study if they had a diagnosis of lateral epicondylitis and an ECRB defect on MRI imaging. Lateral epicondylitis was diagnosed using the following tests: (1) pain on palpation at the lateral epicondyle, (2) pain on resisted wrist extension, and (3) pain on resisted middle-finger extension. Subjects needed to test positive on all 3 tests to be included in the study. The study sample comprised 41 patients with recalcitrant lateral epicondylitis and a partial ECRB tear on MRI (22 men and 19 women; age:  $49 \pm 8$  years; height:  $165 \pm 36$  mm; weight:  $73 \pm 18$  kg). After counseling patients on operative and nonsurgical treatment options, five patients declined nonsurgical treatment and opted for immediate surgery. The remaining 36 patients opted for nonsurgical treatment. The institutional research ethics committee, in line with the Declaration of Helsinki, approved all procedures.

### Experimental design

This was a single-cohort longitudinal outcome study. The study population was identified based on three criteria: (1) a diagnosis of lateral epicondylitis, (2) an MRI-confirmed ECRB tear, and (3) longstanding symptoms (symptoms for at least 6 weeks). Patients were divided into two groups based on whether they underwent surgery or not. Nonsurgical treatment was evaluated by the DASH questionnaire, and surgery was considered a failure of nonsurgical treatment (persistent symptoms after intervention). Nonsurgical treatment was variable and included a mixture of physical therapy, rest, injection therapy, and splinting. Because the study population had recalcitrant lateral epicondylitis, the nonsurgical treatment options were dependent on what prior treatments had been unsuccessful.

### Outcome scores

#### DASH

The DASH outcome scores were administered. The DASH has been validated for use in this population.<sup>4</sup> Follow-up DASH scores were recorded on patients receiving nonsurgical treatment. Patients requiring surgery were considered a failure of nonsurgical treatment, and follow-up DASH scores were not recorded.

#### MRI analysis

A sports medicine fellowship-trained orthopedic surgeon analyzed the MRI images. The common extensor origin and lateral

collateral ligament were specifically evaluated. Enthesopathy of the ECRB origin was defined by an increased signal on T1-weighted images, without an increased signal on T2-weighted MR images, and with or without thickening. Defects of the ECRB origin were defined by thinning of the tendon, surrounded by fluid in T2-weighted images and a gap at the origin.<sup>10</sup> Tendon separation from the common extensor origin from the lateral epicondyle was measured in millimeters. The same surgeon made all measurements of tear size to avoid intertester variability.

### Statistical analysis

Tear size on MRI was compared between patients who had resolution of symptoms with nonsurgical treatment (DASH score  $< 10$ ) vs. those who failed nonsurgical treatment and ultimately had surgery (independent samples t-test). Based on the variability in tear size, it was determined that with a sample of 40 patients, there would be 80% power to detect a 3-mm difference in MRI tear size ( $P < .05$ ) between patients requiring surgery vs. those achieving symptom relief with nonsurgical treatment.

Statistical analyses were performed using SPSS v.21 (IBM, Armonk, NY, USA). Mean  $\pm$  standard deviation values are reported in the tables and results section, whereas mean  $\pm$  standard error values are reported in the figures. A  $P$  value of less than 0.05 was considered statistically significant.

## Results

### Patient outcomes

Of the 41 patients, 5 patients chose immediate surgery without trying nonsurgical treatment, 11 patients had symptomatic relief with nonsurgical treatment, and 25 patients did not have symptom relief with nonsurgical treatment, and of those patients, 19 patients chose surgery, and 6 patients opted not to have surgery (Fig. 1). Of the total 41 patients, 19 patients underwent platelet-rich plasma (PRP) treatment, of which 10 patients had symptomatic relief. Sixteen of the 41 patients had isolated eccentric exercise in addition to standard physical therapy, of which 8 patients had symptomatic relief. Finally, 9 of the 41 patients had corticosteroid injections, of which 2 patients had symptomatic relief.

### DASH scores

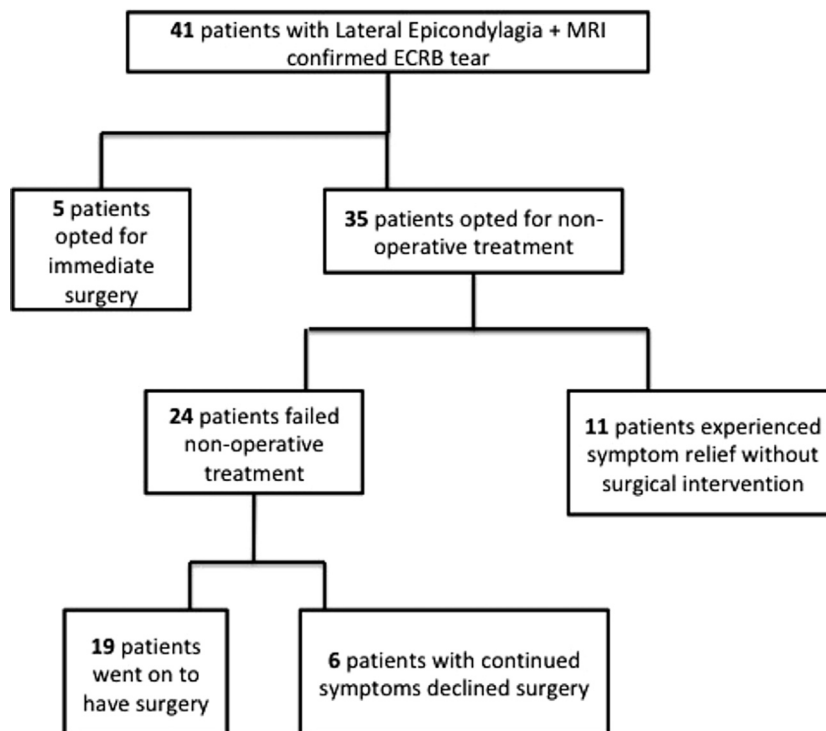
DASH scores for patients who had symptom relief with nonsurgical treatment were  $1 \pm 2$  (range 0–7) at an average of  $2.2 \pm 1.2$  years of follow-up (range 6 months to 4 years). DASH scores for the 6 patients who had continued symptoms but chose not to have surgery were  $47 \pm 15$  (range 26–60) at an average of  $2.1 \pm 1.8$  years of follow-up (range 7 months to 5 years;  $P < .0001$  vs. patients with symptom relief).

### Tear size

Tear size was not different between patients who had symptom relief with nonsurgical treatment vs. patients who had surgery or had continued symptoms but chose not to have surgery (Table 1).

## Discussion

The results of this study showed that ECRB tear size in patients with lateral epicondylitis does not increase the likelihood of failure with nonsurgical treatment. Because tear size did not differ between patients for whom surgery was required, patients who had symptomatic relief with nonsurgical treatment, and patients who



**Figure 1** Flow chart detailing the breakdown of patient outcomes in terms of their course of treatment after diagnosis of lateral epicondylitis + MRI-confirmed ECRB tear. MRI, magnetic resonance imaging; ECRB, extensor carpi radialis brevis.

**Table 1**  
ECRB tear size for each clinical outcome group.

Clinical outcome	# of patients	Time from MRI (mo)	Tear size (cm)	P value vs. patients with symptom relief with nonsurgical treatment
Symptom relief with nonsurgical treatment	11	27 ± 15	7.7 ± 4.3	
Continued symptoms with nonsurgical treatment (declined surgery)	6	25 ± 21	11.4 ± 2.7	.08
Continued symptoms with nonsurgical treatment (chose surgery)	19	2 ± 1	8.5 ± 1.2	.45
Declined nonsurgical treatment (chose immediate surgery)	5	8 ± 6	11.9 ± 2.1	.06

MRI, magnetic resonance imaging; ECRB, extensor carpi radialis brevis.

\*Tear size for all 30 patients who had surgery or continued symptoms is shown in vertically aligned cells with P values vs. the 11 patients with symptom relief with nonsurgical treatment also displayed in a horizontally aligned cell.

had surgery or had continued symptoms but chose not to have surgery, data from this study suggest patients should try nonsurgical treatment before proceeding with surgery. However, despite this lack of difference in tear size between surgical and nonsurgical patients, it is worth noting that only a small percentage of patients with ECRB tears (11 of 41) improve with nonsurgical treatment. Thus, although it may be worth it for some patients to initially try nonsurgical treatment, it is likely the case that most will end up needing additional surgical intervention to fully recover. This study was designed to represent how patients are actually treated in the clinical setting. Given the fact that most health insurance plans only cover a certain number of physical therapy hours per year, this study was designed to assess whether patients presenting at the office were not wasting these hours on an issue that would ultimately require surgical intervention. As hypothesized, the findings confirm that nonsurgical treatment, such as physical therapy with eccentrics, PRP therapy, and corticosteroid injections, can be beneficial in some patients with lateral epicondylitis and a

concomitant ECRB tendon tear. Although these nonsurgical treatments may not be sufficient for all patients with tears, they are still worth exploring, both as a means to improve symptoms and possibly prolong the period where surgery is not yet necessary.

These findings are consistent with data from previously studies. Savnik et al (2004) found that while 83% of patients diagnosed with lateral epicondylitis had ECRB tears on MRI, treatments of wrist splint immobilization or corticosteroid injection resulted in symptomatic relief despite no change in MRI findings.<sup>7</sup> In addition, a negative correlation between MRI findings and symptomatic relief was found by Walton et al (2011), where larger tendon separation on MRI was paradoxically associated with less disability based on QuickDASH scores.<sup>11</sup> Together, these studies indicate that the presence of tear on MRI does not preclude symptom relief with nonsurgical treatment. Thus, patients with a diagnosis of lateral epicondylitis and a concomitant ECRB tear should be afforded the opportunity to try nonsurgical treatments, such as physical therapy with eccentrics, PRP therapy, and corticosteroid injections.

Furthermore, because of the lack of evidence suggesting the presence of ECRB tear size on MRI correlates with worsened symptoms for the patient, surgeons and patients alike should feel comfortable trying such initial nonsurgical approaches without the fear of exacerbating their condition.

It remains to be determined whether the optimal nonsurgical treatment for those with lateral epicondylitis and a concomitant ECRB tear differs from those without a tear.

In a study comparing isokinetic eccentric wrist extensor training with standard physical therapy, Croisier et al (2007) found that pain reduction, disability questionnaire scores, and muscle strength were significantly better among the eccentric group.<sup>2</sup> In another randomized trial, Tyler et al (2010) found similar results, indicating symptomatic improvements and decreased pain among patients in the eccentric group, further suggesting isolated eccentric exercise, in addition to standard physical therapy, was effective in the treatment of lateral epicondylitis.<sup>9</sup> In addition to such eccentric exercise, PRP treatments have also been shown to help in treating chronic lateral epicondylitis.<sup>5,6</sup> Raeissadat et al (2014) found that when combined with a tennis elbow strap, stretching, and strengthening exercises, PRP injections resulted in pain and functional improvements among patients at 8-week follow-ups.<sup>6</sup> Although this study did not differentiate between patients with and without ECRB tears, the research supports effectiveness of PRP injections for nonsurgical treatment of lateral epicondylitis. Corticosteroid injections are commonly used to provide short-term pain relief and diminish disability.<sup>8</sup> However, corticosteroids in the treatment of lateral epicondylitis are only temporarily beneficial. Bisset et al (2006) found that any significant short-term benefits of corticosteroid injections were reversed after six weeks, with high recurrence rates.<sup>1</sup> Interestingly, Peerbooms et al (2010) found that in a study of patients with lateral epicondylitis given either PRP or corticosteroid injections, the corticosteroid group initially improved and then declined, whereas the PRP group progressively improved over time.<sup>5</sup> Although none of the abovementioned studies discussed ECRB tears or the sizing of those tears, the present results indicate that this should not be considered a negative prognostic factor for nonsurgical management of lateral epicondylitis.

### Limitations

One limitation of the present study was that, because it was a chart review, it was not possible to verify the details of prior treatments. In addition, specific details of physical therapy treatments after initial presentation were not recorded on all patients. Another limitation is that it was difficult to accurately verify how long patients had their condition before presentation.

### Conclusion

ECRB tendon defect size on MRI does not predict success or failure of nonsurgical treatment of lateral epicondylitis. Despite MRI evidence of a partial ECRB tear, nonsurgical treatment may be a viable option for some patients with recalcitrant lateral epicondylitis. Patients can be afforded the opportunity to try nonsurgical treatment regardless of the presence of a concomitant ECRB tear.

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