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Incidental magnetic resonance imaging signal changes in the extensor carpi radialis brevis origin are more common with age

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Background: Patients with enthesopathy of the extensor carpi radialis brevis (ECRB) demonstrate signal changes on magnetic resonance imaging (MRI). It is likely that these MRI changes persist for many years or may be permanent, regardless of symptoms, and represent an estimation of disease prevalence. We tested the hypothesis that the prevalence of incidental signal changes in the ECRB origin increases with age.

Methods: We searched MRI reports of 3374 patients who underwent an MRI scan, including the elbow, for signal changes in the ECRB origin. Medical records were reviewed for symptoms consistent with ECRB enthesopathy. Prevalences of incidental and symptomatic signal changes were calculated and stratified by age. We used multivariate logistic regression analysis to test whether age, sex, and race were independently associated with ECRB enthesopathy and calculated odds ratios.

Results: Signal changes in ECRB origin were identified on MRI scans of 369 of 3374 patients (11%) without a clinical suspicion of tennis elbow. The prevalence increased from 5.7% in patients aged between 18 and 30 years up to 16% in patients aged 71 years and older. Older age (odds ratio, 1.04; $P < .001$) was independently associated with the incidental finding of ECRB enthesopathy on elbow MRI scans.

Conclusions: Increased MRI signal in the ECRB origin is common in symptomatic and in asymptomatic elbows. Our findings support the concept that ECRB enthesopathy is a highly prevalent, self-limited process that seems to affect a minimum of 1 in approximately every 7 people.

Level of evidence: Level IV; Diagnostic Study

Keywords: Extensor carpi radialis brevis; enthesopathy; tennis elbow; lateral epicondylitis; MRI; prevalence

Enthesopathy of the extensor carpi radialis brevis (eECRB) origin is characterized by histopathologic changes consistent with mucoid and hyaline degeneration that appear as increased signal intensity on magnetic resonance imaging (MRI).[2,9,10,12] When eECRB is causing symptoms, patients experience point tenderness over the lateral epicondyle and pain with resisted wrist extension and passive wrist flexion.

This study protocol was approved by the Institutional Review Board of the Massachusetts General Hospital (Protocol No. 2009P001019).

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Symptomatic eECRB is more commonly known by the colloquialism "tennis elbow" and the misnomer "lateral epicondylitis".[13] The disease typically occurs in middle-aged (35 to 65 years) patients of both sexes.[15,16] The enthesopathies of human middle age (e.g., plantar fascia, rotator cuff, ECRB origin, patellar tendon, and Achilles tendon) are idiopathic, noninflammatory disease processes affecting the attachment of soft tissue to bone (the enthesis).[18,19,23] The enthesopathies of middle age are benign and self-limiting in most cases.[16]

Diagnosis is based on interview and examination. MRI detects signal changes consistent with eECRB of nearly every patient with characteristic symptoms and limitations.[7,8,19] Its role in management is debated because the symptoms and signs are so characteristic and misinterpretation of the MRI findings as a "tear" of the ECRB origin or the lateral collateral ligament might lead to overtreatment or mistreatment.[1,5,11,20,21] In addition, signal changes in the ECRB are a common incidental finding on MRI scans of patients without lateral-sided elbow pain.[14,17,19]

Considering other enthesopathies, such as rotator cuff or Achilles enthesopathy, it seems likely that the pathology and MRI signal changes associated with eECRB, persist for many years after symptoms resolve and might even be permanent.[2,18] If so, signal changes in the ECRB origin on MRI would be more prevalent with age, regardless of symptoms.

Our primary study objective was to assess the prevalence of incidental (asymptomatic) signal changes in the ECRB origin in patients who underwent MRI, including the elbow. We tested the primary null hypothesis that the prevalence of incidental signal changes in the ECRB on MRI scans does not increase with age. In addition, we assessed factors associated with incidental and overall prevalence of signal changes in the ECRB origin.

Materials and methods

Study design, setting, and patient selection

The Institutional Review Board granted a waiver of informed consent. We identified radiology reports of all MRI scans of the upper extremity performed at 1 of 2 institutions between December 31, 2004, and January 1, 2015. Only patients aged 18 years or older at the time of the MRI were included, resulting in 17,324 patients with 22,691 MRI scans of the upper extremity. For 3374 patients with 4617 scans, at least 1 of the scans covered the elbow region. Only reports for the first MRI scans were included for each patient.

Outcome measures and explanatory variables

Our primary outcome measure was the presence of signal changes in the common extensor tendon origin on MRI. We selected patients with possible signal changes by text searching the radiology reports of their MRI scan for "common extensor origin," as well as terms indicating signal changes, and common misspellings and synonyms (Appendix I). The common extensor origin was not specifically mentioned in 1442 reports.

We manually reviewed all MRI reports that were identified by our search to confirm the presence of reported signal changes in the common extensor origin (n = 1932). Patients with inflammatory arthropathy (n = 21) or severe osteoarthritic changes (n = 16) of the elbow and signal changes in the common extensor origin were considered as not having common extensor enthesopathy.

The indications for obtaining the MRI scans were categorized. Patients had 1 (1114 [33%]), 2 (1126 [33%]), 3 (687 [20%]), or 4 or more (290 [8.6%]) of the categorized indications for their MRI scan. Indications were unclear or did not fit into one of the categories for 157 patients (4.7%), and these were categorized as "other or unknown."

We reviewed medical records and clinical indications for MRI scans for all patients identified as having common extensor signal changes to assess if the changes were an incidental finding. We considered as incidental common extensor origin signal changes on MRI scans of patients without a medical history or indication containing lateral-sided elbow pain or a clinical suspicion of lateral epicondylitis. Electronic medical records were readily available for all patients.

Explanatory variables were age at the time of imaging, sex, race, and the indication for the MRI scan.

Statistical analyses

Categoric variables are presented as frequencies and percentages and continuous variables as mean with the standard deviation (SD).

Patients were divided into six groups based on their age: (1) between 18 and 30 years (mean, 23; SD, 4.0 years), (2) between 31 and 40 years (mean, 36; SD, 3.0 years), (3) between 41 and 50 years (mean, 46; SD, 2.8 years), (4) between 51 and 60 years (mean, 55; SD, 2.8 years), (5) between 61 and 70 years (mean, 65; SD, 2.8 years), and (6) 71 years and older (mean, 78; SD, 5.7 years). The number of incidental common extensor signal changes is also demonstrated per age group as a proportion of all patients who had an MRI scan of the elbow that was not ordered for lateral-sided pain. We used a locally weighted scatterplot smoothing (LOWESS) graph to demonstrate the gradual change in incidental and overall common extensor signal changes as a function of age.

In multivariable logistic regression analyses, the association of explanatory variables—age, gender, race, and indications for MRI—with incidental and all common extensor signal changes were assessed, accounting for possible confounding by any of the included factors. Adjusted odds ratios (ORs) are provided with 95% confidence intervals (CIs) and *P* values.

Demographics

The study included 3374 patients who underwent an MRI scan including the elbow, of whom 2040 were men (60%). The mean age at MRI for men was 44 (SD, 15) years compared with 50 (SD, 15) years for women ($P < .001$ by unpaired t test). The overall mean age at MRI was 46 (SD, 16) years. Most patients were Caucasian (2583 [77%]; Table I).