Effectiveness of Magnetic Resonance Imaging in Detecting Partial and Complete Distal Biceps Tendon Rupture

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Purpose A magnetic resonance imaging (MRI) scan of the elbow is often obtained to confirm the clinical suspicion of a distal biceps tendon rupture. The goal of this study was to evaluate the effectiveness of MRI in diagnosing partial and complete distal biceps tendon ruptures as determined at the time of surgery.

Methods We identified 22 partial and 24 complete distal biceps tendon ruptures operated on by a single surgeon. The preoperative MRIs of these patients were obtained, along with MRIs of the elbow in 10 asymptomatic individuals. Two musculoskeletal radiologists read each MRI without knowledge of the diagnosis or the surgical findings. Their interpretations were compared with the intraoperative findings and the results were statistically analyzed.

Results The overall sensitivity and specificity of MRI were 92.4% and 100%, respectively, in detecting distal biceps tendon ruptures. The sensitivity and specificity of MRI for complete tears were 100% and 82.8%, respectively. The sensitivity and specificity of MRI for partial tears were 59.1% and 100%, respectively.

Conclusions Magnetic resonance imaging is an effective tool for diagnosing distal biceps tendon ruptures. Although MRI is extremely sensitive in diagnosing complete tears, it is substantially less sensitive in diagnosing partial tears. *(J Hand Surg 2010;35A:77–83. Copyright © 2010 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Diagnostic II.

Key words MRI, distal, biceps, tendon.

Not all patients present with the classic signs and symptoms of a complete distal biceps tendon rupture.[1–17] Complete tears without retraction and partial tears may have a more subtle presentation than complete, retracted tears. Such tears may not present with the usual proximal muscle migration and associated ecchymosis. Patients with partial distal biceps tendon tears may present with mild thickening of the distal tendon or subtle proximal migration of the musculotendinous junction. Many times the only report is anterior elbow pain. Sometimes the symptoms may even mimic or coexist with other conditions such as bicipital tendinosis.[18] Sometimes the diagnosis of chronic distal biceps tendon tears can even be missed or delayed.[2,19–23]

When the diagnosis of distal biceps tendon rupture is suspected but uncertain, a magnetic resonance image (MRI) of the elbow is frequently obtained. Several studies have evaluated the use of MRI to diagnose partial and complete distal biceps tendon ruptures. These studies have predominantly focused on describing the characteristic MRI findings. Whereas these studies comment on the accuracy of MRI in detecting partial and complete tears, none have con-

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firmed all their cases surgically.[24–26] O'Driscoll et al compared the accuracy of MRI and surgical findings when evaluating the accuracy of a specific physical examination maneuver (the hook test).[27] To our knowledge, no study has been performed whose primary goal was to evaluate the sensitivity and specificity of MRI for detecting partial and complete tears of the distal biceps tendon.[24–28] This was the primary purpose of our study.

MATERIALS AND METHODS

We obtained internal review board approval at the participating institution before the study commenced. A consecutive series of 46 patients who had an MRI and underwent surgical repair for partial or complete distal biceps tears between 1996 and 2006, by a single surgeon at a single hospital, was identified from the surgeon's personal database. Elbow MRIs performed during the preoperative work-up of these patients were obtained. To be included in this study, the MRI images had to satisfy the following criteria: (1) the patient's name and birth date, the date of study, and the extremity imaged had to be identifiable on the study; (2) an area from proximal to the biceps musculotendinous junction to past the radial tuberosity had to be viewable on the study; (3) the MRI hardware needed a magnet strength of 1.5 T; (4) no contrast was used. Because a small proportion of patients were referred with MRIs from outside institutions, a standard protocol for obtaining images could not be used. All scans included T1, T2, and a fluid/edema-sensitive sequence in the axial, sagittal, and coronal planes.

We performed a chart review to identify the time between symptom onset and MRI, and the time between MRI and surgery. For study purposes, tears were defined as acute or chronic based on the timing of MRI. Acute tears were defined as less than or equal to 4 weeks from symptom onset to MRI scan. Chronic tears were defined as greater than 4 weeks from symptom onset to MRI scan. Chart review was performed to identify pertinent patient demographics, as well as pertinent intraoperative findings.

To be included in the study, patients had to satisfy the following criteria: (1) age greater than 18 years; (2) no previously diagnosed elbow injury or condition; and (3) no previous elbow surgery.

We used surgical notes to identify the degree of distal biceps tendon tear and the presence of tendon retraction. A complete distal biceps tendon tear was defined as a complete loss of the normal attachment of the distal end of the biceps tendon to the radial tuberosity. A tendon that was weakly attached to the tuberosity by either scar or pseudotendon was considered a complete tear. Scar or pseudotendon could easily be divided by blunt dissection. Conversely, if any tendinous attachment to the radial tuberosity remained, the tear was defined as partial. With partial tears, the remaining fibers could not be separated by blunt dissection; the fibers needed to be sharply transected to mobilize the tendon for repair. For incomplete ruptures, we estimated the percentage of tendon rupture by determining what percentage of the distal biceps was still attached. This estimation was facilitated by transecting the remaining distal biceps tendon fibers that were still attached to the tuberosity.[6,17,22] For study purposes, a low-grade partial tear was defined as less than or equal to a 50% tear of the distal biceps tendon attachment. A high-grade partial tear was defined as a greater than 50% tear of the distal biceps tendon attachment. Surgical findings were considered the reference standard for identifying complete or incomplete distal biceps tendon tears in this study. We also obtained MRI images of 10 elbows of asymptomatic individuals who were recruited solely to serve as a control group.

Two fellowship-trained musculoskeletal radiologists read each MRI scan in random order without knowledge of the diagnosis. The radiologists participating in this study had no role in the original care of any patient involved in this study. The radiologists were told that the indication for MRI was suspicion of a distal biceps tendon injury, but they were unaware which films were from patients with surgically confirmed distal biceps tendon ruptures and which were from asymptomatic controls. They were asked to characterize the distal biceps tendon as intact, partially torn, or completely torn. If the radiologist suspected a partial distal biceps tendon tear, he was asked to characterize it as either a high-grade or low-grade tear using the definition provided. The radiologists were also instructed to document the presence (or absence) of (1) tendon discontinuity, (2) intratendinous signal, (3) increased peritendinous fluid, (4) increased signal in the biceps muscle, (5) increased signal in the surrounding soft tissues, and (6) edema in the radial tuberosity. The MRI interpretations were then compared with the intraoperative findings and the results were statistically analyzed (SPSS Software, Chicago, IL). Values reported for sensitivity, specificity, positive predictive value, and negative predictive value were calculated for each radiologist. The reported numbers in this study represent the mean values calculated from each radiologist's results. The radiologists were instructed not to discuss the cases with one another.