Magnetic Resonance Imaging Evaluation of the Distal Biceps Tendon

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Take Home Points

- There are a variety of injuries to the distal biceps tendon.
- Injuries vary from tendinosis to full thickness, retracted tears.
- The degree of retraction of full thickness tears depends on the integrity of the lacertus fibrosis.
- The FABS view allows for MRI of the entire length of the distal biceps tendon.
- MRI is the most useful imaging modality to determine the integrity of the postoperative biceps tendon.

Distal biceps tendon injuries are uncommon (1.2 per 100,000 patients in one study). An underlying degenerative component is involved in all distal biceps tendon tears and tendinosis. Partial tears can be caused by the same mechanism or by no particular inciting event. Magnetic resonance imaging (MRI) is the optimal imaging modality for distal tendon tears because of its excellent specificity and sensitivity in the detection of complete tears. Imaging also accurately diagnoses and characterizes partial tears and tendinosis. On MRI, fast spin-echo intermediate-weighted and T2-weighted or short tau inversion recovery (STIR) sequences are normally obtained to assess tendon integrity. Along with standard axial and sagittal views, the FABS (flexed elbow, abducted shoulder, supinated forearm) view is an important tool in the diagnosis of distal biceps tendon tears. The FABS view is obtained with the patient prone with the shoulder abducted 180° (above the head), with the elbow flexed to 90°, and the forearm supinated. This position allows a longitudinal view of along the entire length of the distal tendon.

Complete distal biceps tears can usually be diagnosed by history and physical examinations. However, imaging can be helpful when intact brachialis function can compensate for a completely torn tendon. MRI is also useful in
the setting of a complete tear to locate the torn tendon stump, and assess the degree of retraction for tendon retrieval\textsuperscript{7,8} and quality of the tendon stump for repair. For associated rupture of the lacertus, the degree of proximal tendon retraction can be significant (\textbf{Figures 1A, 1B}). Given that distal biceps tendon rupture occurs as an avulsion at the tendon-bone interface (\textbf{Figure 2}), complete distal biceps tendon tears typically demonstrate no tendon at the insertion on the radial tuberosity with a fluid-filled tendon gap with edema and/or hemorrhage\textsuperscript{7,8} or an ill-defined T2-hyperintense mass at the expected site of the tendon.\textsuperscript{7} Complete tears without rupture of the lacertus fibrosis (bicipital aponeurosis) will have a small amount of retraction because the intact aponeurosis tethers the torn tendon stump (\textbf{Figures 3A-3C}). Chronic complete tears demonstrate heterogeneous signal intensity and fluid signal at the tendon, as well as muscle belly atrophy.\textsuperscript{9} A small percentage of distal biceps brachii tendons are bifid\textsuperscript{10} (\textbf{Figure 4}). When injured, 75\% have complete rupture of the short head with 17\% of these having additional complete rupture of the long head, whereas 50\% of those with complete rupture of the short head have partial tear or tendinosis of the long head.

Partial distal bicep tears are characterized on MRI by focal or partial detachment of the tendon at the radial tuberosity with fluid filling the site of the tear. The degree of partial tearing can be assessed on MRI (\textbf{Figures 5A, 5B}). In distal biceps tendinosis, increased signals of thickened tendon fibers at the radial tuberosity are evident without focal discontinuity\textsuperscript{7,8} (\textbf{Figures 6A-6C}). Patients may display attenuation of the distal tendon fibers or adjacent fluid distension representing bicipitoradial bursitis (\textbf{Figures 7A, 7B}).

MRI is useful in assessing the distal biceps tendon in the postoperative setting to evaluate the integrity of a repaired tendon. Cortical fixation button technique for repair creates minimal susceptibility artifacts on MRI. Postoperative MRI typically demonstrates a transverse hole drilled through the proximal radius at the site of the tuberosity with a cortical fixation button flush against the posterior radial cortex (\textbf{Figures 8A-8D}). The postoperative complication of heterotopic ossification can occasionally be observed on plain radiograph at the site of surgery, but it is less common with the current surgical technique than in the past.\textsuperscript{11}

\section*{Key Info}

\section*{Figures/Tables}

\textbf{Figures / Tables:}

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Figure 1. (A) Multiple sequential axial intermediate images, (a-f) proceeding proximal to distal, demonstrate a proximally retracted stump of the avulsed ruptured distal biceps tendon (arrow) at the level of the proximal humerus due to concomitant rupture of the lacertus fibrosis. Hemorrhage and edema are observed along the expected course of the distal biceps tendon (dashed arrows) from the level of anecubital fossa to the level of the radial tuberosity (asterisk), which is the site of tendon avulsion. (B) Sagittal, fluid-sensitive image demonstrates complete rupture of the distal biceps tendon and lacertus fibrosis with retraction of the tendon stump (solid arrow) to the level of the distal humerus. Edema and hemorrhage are observed along the course of the ruptured tendon (dotted line).

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Figure 2. Lateral radiograph of the elbow displaying a cortical defect at the expected location of the radial tuberosity (dotted line) with proximal retraction of the osseous fragment (circle). The results are consistent with a rare biceps tendon osseous avulsion of the radial tuberosity.

Figure 3. Full thickness tear of the distal biceps tendon. Multiple sequential, axial, and intermediate-weighted images of the distal biceps tendon proceeding from proximal to distal (A to C). (A) The proximally torn tendon stump (circle) remains tethered to the lacertus fibrosis (arrow), which prevents the torn tendon from retracting above the elbow joint. (B) The torn tendon stump (circle) is diffusely thickened and increased in signal with retraction from the greater tuberosity. (C) Imaging at the radial tuberosity reveals no remaining intact tendon fibers at the radial tuberosity attachment (dashed oval). This result is consistent with a tendinous avulsion.
Figure 4. Axial intermediate-weighted image of the distal biceps tendon reveals 2 low-signal structures in the expected location of the distal biceps. These structures are consistent with normal, discrete, bifid tendons of the short (square) and long (circle) heads of the biceps. The distal brachialis tendon is located deep in the bifid tendon (arrow).

Figure 5. Axial intermediate-weighted images of the distal biceps tendon. (A) Imaging of the radial tuberosity demonstrates marked heterogeneity of the distal biceps tendon (arrows) with marked attenuation of the insertional fibers (dashed arrow). (B) Proximal retraction of the torn fibers exhibits a bulbous, irregular tendon (circle). Findings are compatible with a partially torn distal biceps tendon.
Figure 6. (A) Axial intermediate-weighted and (B) T2 with fat saturation images of the distal biceps tendon insertion on the radial tuberosity. The distal biceps tendon is diffusely thickened and increased in signal intensity on both sequences (arrows) with loss of normal low-signal morphology. These findings are consistent with moderate insertional tendinosis. A skin marker on the volar surface of the antecubital fossa was placed at the site of the patient’s pain (oval). (C) Flexed, abducted image of the elbow shows the entirety of the length of the distal biceps tendon (arrows). The distal tendon fibers are irregular and increased in signals compatible with moderate tendinosis. Bright signals surrounding the tendon represent fluid from bicapital radial bursitis.

Figure 7. (A) Axial intermediate-weighted and (B) fluid-sensitive images at the level of the radial tuberosity demonstrate focal fluid surrounding the distal biceps tendon at its insertion on the radial tuberosity. These images also illustrate distention of the tendon sheath, which is proximally (oval) compatible with bicapital radial bursitis.
Figure 8. Imaging after distal biceps tendon repair. (A) Axial intermediate-weighted and (B) short tau inversion recovery (STIR) with intact distal biceps tendon repair. The distal biceps tendon is intact and threaded through a tunnel (dashed arrows) with a cortical fixation button (solid arrows). This patient was imaged for persistent pain after previous repair. Imaging revealed a partial thickness tear at the insertion of the biceps tendon (asterisks). (C) Axial and (D) sagittal intermediate-weighted images of complete rupture of the distal biceps tendon after repair. Axial image demonstrates drill track (dashed arrow) and cortical fixation button (solid arrow) at the radial tuberosity from prior distal biceps tendon repair. The distal biceps tendon is absent from its attachment at the radial tuberosity (asterisk). (D) On the sagittal image of the stump of the tear, previously repaired tendon is retracted proximally. Multiple low-signal foci on both images (circles) represent susceptibility artifacts from microscopic pieces of metal dispersed into the soft tissue from cortical drilling.

References
References


Multimedia
Product Guide

- STRATAFIX™ Symmetric PDS™ Plus Knotless Tissue Control Device
- STRATAFIX™ Spiral Knotless Tissue Control Device
- BioComposite SwiveLock Anchor
- BioComposite SwiveLock C, with White/Black TigerTape™ Loop

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