Case Report

Ultrasound Assessment of an Isolated Rupture of the Medial Bundle of a Bifid Distal Biceps Tendon

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Abstract

This case study describes a patient with a clinically ruptured distal biceps tendon, with ultrasound detecting an isolated rupture of the medial bundle of a bifid distal biceps tendon. A 45-year-old male presented to the accident and emergency department with a week-old history of a right elbow injury. The ultrasound scan demonstrated a hypoechoic, corrugated distal biceps tendon with a tendon stump close to the radial tuberosity insertion in keeping with a rupture. However, a small caliber accessory or bifid distal biceps tendon was also identified and was intact. Typically, distal biceps tendon ruptures occur following a traumatic event with most detected clinically although imaging is required to confirm the diagnosis. Ultrasound is utilized to assess these injuries, and several different techniques or approaches are described in the literature. A combination of these approaches is required to make an accurate diagnosis. Detection of bifid distal biceps tendons is important for patient management, especially if a surgical repair is considered. This case highlights the anatomical variant of a bifid distal biceps tendon, which was ruptured clinically. The ultrasound diagnosis of distal biceps tendon ruptures can be challenging, especially when there is limited tendon retraction. This case also demonstrated the importance of dynamic ultrasound in the assessment of tendon ruptures.

Keywords: Bifid, distal biceps tendon, elbow, musculoskeletal ultrasound

Introduction

Distal biceps brachii injuries are uncommon, presenting more commonly in males and following trauma.[1] Clinical indications include ecchymosis in the distal arm/forearm, reduced strength or power, a positive distal biceps provocation test, and a positive hook test.[2] This case study reports on a clinically ruptured distal biceps tendon that, on ultrasound, there was an anatomical variation with an isolated tendon rupture confined to the medial bundle of a bifid distal biceps tendon, subsequently confirmed surgically. A detailed assessment of patient history, clinical care pathway, and ultrasound appearances is presented.

Case Report

A 45-year-old male presented to the accident and emergency with a week-old right elbow injury while lifting a heavy object, experiencing a sudden pain with a "popping" sensation to the anterior elbow. There were reduced arm strength and a positive hook test as no tendon could be palpated with ecchymosis along the medial forearm. Elbow radiographs performed to exclude an avulsion fracture were unremarkable. An elbow ultrasound for a suspected distal biceps tendon rupture was performed.

The biceps muscle was normal with no evidence of a hematoma to suggest a musculotendinous junction injury. Fluid and hematoma surrounded the distal biceps tendon in the paratenon [Figures 1 and 2]. There was hypoechoic thickening with loss of the normal fibrillar pattern in the distal biceps tendon, with a rounded tendon stump close to the radial tuberosity insertion, indicating a ruptured distal biceps tendon [Figure 3]. The bicipital aponeurosis was intact, explaining the limited tendon retraction. On dynamic supination and pronation of the forearm, there was no tendon movement indicating a rupture. When undertaking this maneuver, a

Received: 13-05-2022 **Revised:** 13-06-2022 **Accepted:** 22-07-2022 **Available Online:** 07-10-2022

Video available on: https://journals.lww.com/jmut

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DOI: 10.4103/jmu.jmu_45_22

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How to cite this article: Charnock M. Ultrasound assessment of an isolated rupture of the medial bundle of a bifid distal biceps tendon. J Med Ultrasound 2023;31:323-6.

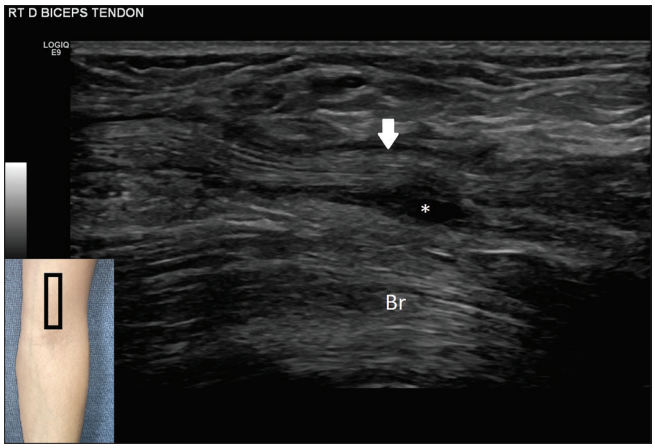

Figure 1: Longitudinal ultrasound image of the distal biceps tendon showing a corrugated appearance (arrow) with fluid and hematoma in the paratenon (asterisk). Br: Brachialis muscle

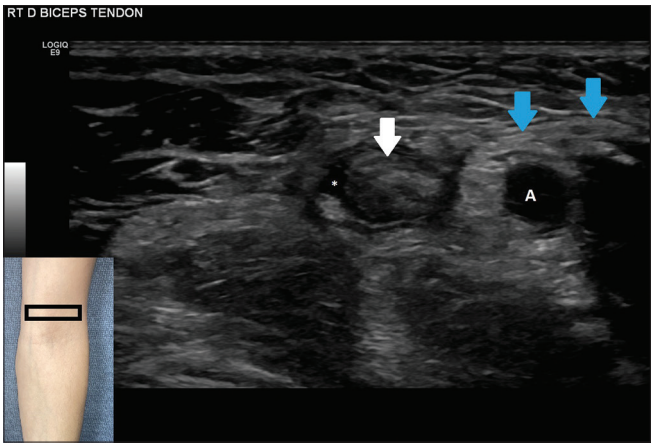

Figure 2: Transverse ultrasound image of an abnormally thickened ruptured distal biceps tendon (white arrow) surrounded by fluid and hematoma (asterisk), with an intact bicipital aponeurosis (blue arrow). A: Brachial artery

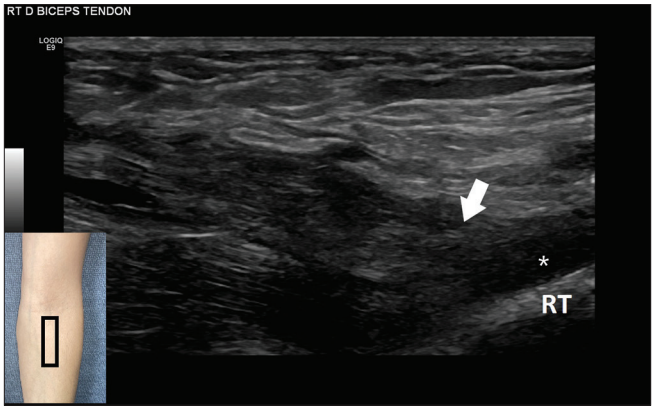

Figure 3: Longitudinal ultrasound image of the corrugated distal biceps tendon at the insertion, demonstrating a rounded tendon stump (arrow) with only fluid and hematoma at the radial tuberosity (asterisk). RT: Radial tuberosity

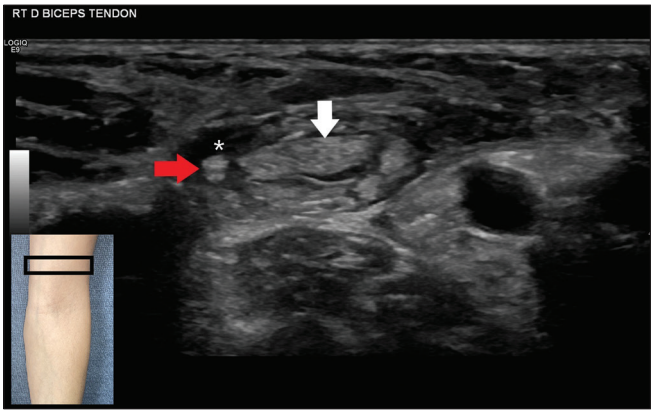

Figure 4: Transverse ultrasound image of the distal biceps tendon. Thickened and ruptured distal biceps tendon (white arrow) with surrounding hematoma (asterisk). Intact accessory distal biceps tendon (red arrow) could be identified separately, with movement on dynamic forearm supination and pronation

small caliber tendon was identified laterally to the ruptured distal biceps tendon [Figures 4 and 5]. This small caliber tendon could be identified separately to the ruptured distal biceps tendon at the musculotendinous junction [Figure 6] and, although difficult, could be traced to the radial tuberosity. Appearances were consistent with an accessory or bifid distal biceps tendon. On dynamic supination and pronation of the forearm, this accessory tendon could be seen moving indicating that this was intact [Video 1]. Appearances indicated a bifid distal biceps tendon with a ruptured short head tendon (medial bundle) and a small caliber long head tendon (lateral bundle) intact.

The patient had a surgical repair, confirming a bifid distal biceps tendon with rupture of the short head tendon (medial bundle) and intact long head tendon (lateral bundle) intraoperatively. The repair was performed via an anterior approach with the arm in hypersupination, to protect the posterior interosseous nerve during surgery, and with an endobutton securing the tendon. Postoperatively, the patient was placed in a collar and cuff and reviewed in clinic 3 weeks after surgery and changed to a sling. The patient made a full and uneventful recovery with no further imaging follow-up required.

Discussion

Distal biceps tendon injuries are uncommon, occurring in men aged between 40 and 60 years, with a reported rate of 1.2/100,000 people.[1] The dominant extremity is mainly affected with other risk factors including the use of anabolic steroids and smoking.[3] The mechanism of injury is intense extension force applied to the anterior forearm with a flexed elbow.[1] The hook test involves palpation of the distal biceps tendon with the elbow flexed to 90° and has a high sensitivity and specificity for rupture.[2] However, palpation of either the brachialis muscle or bicipital aponeurosis can suggest an intact distal biceps tendon. A loss of the normal biceps muscle contour may be present with a ruptured and retracted distal

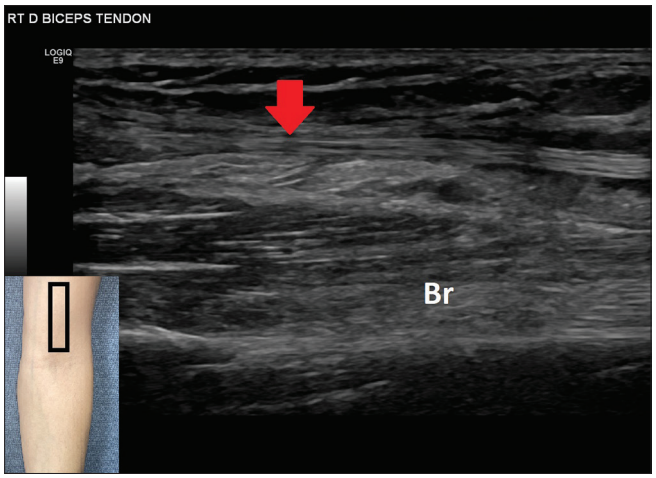

Figure 5: Longitudinal ultrasound image of the intact long head component of the bifid distal biceps tendon (red arrow) demonstrating a normal thin uniform linear hyperechoic tendon. Br: Brachialis muscle

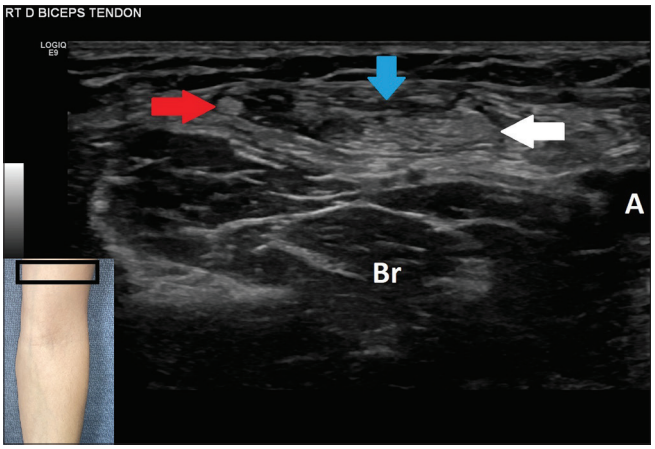

Figure 6: Transverse ultrasound image of the musculotendinous junction (blue arrow) demonstrating the short head component (white arrow) and long head component (red arrow) as two distinct structures. The short head component (white arrow) was the ruptured element of the bifid distal biceps tendon. Br: Brachialis muscle, A: Brachial artery

biceps tendon, although a rupture can be missed clinically when the bicipital aponeurosis remains intact.

The distal biceps tendon has been described as a single tendon between the biceps musculotendinous junction and radial tuberosity, although this case describes a bifid tendon. A cadaveric study reported most distal biceps tendons leave the long and short head muscles as two discrete tendons, combining distally before the radial tuberosity insertion.[4] Biomechanically, the short head is a more efficient elbow flexor and supinator in a neutral and pronated forearm, whereas the long head is a more efficient supinator in an already supinated forearm.[5] The long head tendon inserts more proximally and occupies most of the radial tuberosity, whereas the short head tendon inserts distally.[6] As each musculotendinous unit has distinct insertions, this would allow potential disruption of one component. Several papers have reported an isolated bifid distal biceps tendon rupture.[7-11] However, patients either had no imaging or were imaged using magnetic resonance imaging (MRI) and, to the authors' knowledge, this is the first study to report this anatomical variation on ultrasound. Similarly, to previous studies, the medial bundle from the short head of biceps was ruptured with preservation of the long head, confirmed intraoperatively. Rupture of only the short head component is uncertain, although one explanation is that the more distal insertion of the short head component may make this more susceptible for rupture.[9]

The distal biceps tendon was corrugated, thickened, and hypoechoic with a tendon stump close to the radial tuberosity, indicating a rupture with limited tendon retraction due to an intact bicipital aponeurosis. In this instance, careful scanning and different ultrasound approaches are required to reach an accurate diagnosis. The steep and oblique course of the distal biceps tendon causes anisotropy, an artifact resulting in abnormal or loss of echogenicity, which could lead to a misdiagnosis of a tear or tendonopathy.[12] This is overcome by ensuring that the transducer is perpendicular to the tendon achieved by applied pressure on the distal half of the transducer (heel–toe maneuver) or beam steering. Several different approaches have been described in the literature including anterior, medial, lateral, and posterior approach with the arm in a prone position.[3] In practice, a combination of approaches is required to assess the tendon from the musculotendinous junction to the radial tuberosity.

Ultrasound offers several advantages over MRI in detecting distal biceps tendon injuries including the reduced expense, portability, clinical correlation, and patient interaction during the examination.[14,15] Ultrasound can also be performed for claustrophobic patients and those patients who have contraindication to MRI. Dynamic assessment was also particularly useful in this case, demonstrating an intact long head component with a ruptured short head component. Dynamic assessment is particularly helpful when differentiating between partial and complete tears, which can be difficult to determine when there is limited tendon retraction.[1] Several papers comparing ultrasound to surgical finding reported ultrasound as highly accurate in determining tendon ruptures and supports the recommendation of ultrasound as a first-line test to evaluate distal bicep tendon injuries.[1,3,13] However, ultrasound is operator dependent and has difficulty in assessing distal biceps tendons in obese or very muscular patients, and in these circumstances, an MRI scan may provide a more accurate assessment.[1,15]

Conclusion

There are limited cases reported of an isolated rupture to the medial bundle of a bifid distal biceps tendon, and to the authors' knowledge, this is the first reported and described on ultrasound. Most injuries are diagnosed clinically, although ultrasound plays an important role regarding patient management. Ultrasound is an excellent tool for assessing distal biceps tendon ruptures, although the understanding of anatomy and careful

probe manipulation are crucial to obtain an accurate diagnosis. Practitioners should be aware of anatomical variation and the ultrasound appearances, as this provides surgeons with useful information before contemplating surgical intervention.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that his name and initials will not be published and due efforts will be made to conceal the identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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