Anatomical peculiarities and common pathologies of distal biceps brachii tendon

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Learning objectives

This educational exhibit aims at illustrating the anatomy of the distal biceps brachii tendon emphasizing on certain less known anatomical traits of the tendon. The imaging charateristics of common pathologies affecting the distal biceps brachii tendon are also discussed.

Background

Pathologies of distal biceps tendon commonly cause anterior elbow pain. A thorough knowledge of the anatomical peculiarities and imaging features of the common pathologies of the tendon is important for early diagnosis and treatment [1,2].

Findings and procedure details

Anatomy:

The biceps brachii muscle consists of two heads, the short head and the long head, which originate from the coracoid process of the scapula and the supraglenoid tubercle, respectively. The two heads fuse with each other inferior to the bicipital groove.

Anatomical peculiarities of distal biceps brachii tendon (Fig. 1):

Some studies noted complete separation of the two muscle bellies along their entire course or some degree of interdigitation of the muscle bellies proximal to the distal tendon but with two separate tendons till the point of insertion on the radial tuberosity[3-7].

The tendon of the short head attaches distally and anteriorly whereas the tendon of the long head attaches proximally[3-4].

Distal biceps tendon is not invested by a synovial sheath but covered by a paratenon[8].

A bursa, called the bicipitoradial bursa, surrounds the distal biceps tendon and decreases friction between the tendon and the radial tuberosity during pronation and supination[9].

A thin fibrous structure known as the bicipital aponeurosis or lacertus fibrosus arises from the biceps tendon at the myotendinous juction and extends medially to blend with the fascia of the forearm[3,6,7]. The lacertus fibrosus when intact, may prevent a ruptured biceps tendon from retracting proximally. Transaxial MR images are useful in evaluation of lacertus fibrosus (Fig. 2).

The distal biceps brachii tendon anatomy and pathologies can be best evaluated by ultrasound and MRI.

With ultrasound, three approaches are possible for visualisation of the tendon: anterior approach with arm extended and forearm supinated and the medial and lateral approaches with elbow in 90 degree flexion and supinated forearm. The oblique course of the tendon causes anisotropy and difficulty in visualisation of distal-most part due to anisotropy with anterior approach. The medial and lateral approaches minimise the anisotropy effect and improve visualisation of the tendon[1,10,11].

With MR imaging, transaxial images from the musculotendinous junction to the insertion of the biceps tendon on the radial tuberosity are most useful. Sagittal MR images are useful in some cases[8].

Pathologies:

Tear: The tendon usually tears at its insertion on the radial tuberosity and less comonly at the myotendinous junction[1]. The tear can be partial or complete and may involve one or both tendon heads[12-14]. Acute complete tear is most commonly caused by a strong contraction of the biceps against resistance as in heavy weight lifters. Early diagnosis and surgical repair is important to prevent chronic weakness.

Findings of an acute complete tendon tear include tendon discontinuity with proximal retraction of the tendon stump and hemorrhage or hematoma in the tendon gap (Fig. 3). On ultraound, posterior acoustic shadowing may be seen at the retracted tendon stump. Absence or minimal retraction of the tendon may occur if the lacertus fibrosus remains intact. The status of lacertus fibrosus can be assessed on transaxial MR images.

Partial tear is usually non traumatic. The pathogenesis is not clear[8]. Imaging features of partial tendon tear include thinning or thickening of the tendon, focal areas of altered echogenicity or increased signal intensity (Fig. 4). On ultrasound, loss of fibrillar pattern of the tendon is seen. An associated distension of the bicipitoradial bursa may be seen.

Tendinosis: tendinosis, defined as intrasubstance degeneration[15] may occur in the distal biceps tendon in a relatively hypovascular zone, approximately 10mm from its insertion on the radial tuberosity. This zone is subject to mechanical impingement due to repititive pronation movement and subsequent degeneration which is a predisposing factor for tendon tear[16]. On ultrasound, tendinosis is seen as thickened hypoechoic tendon. On MRI, the tendon is thickened and shows increased signal intensity. Partial tendon tear may co-exist with tendinosis. Both conditions also have common imaging features hence differentiation between tendinosis and partial tears can often be challenging (Fig. 5).

Calcifying tendinitis: acute calcific tendinitis in distal biceps tendon occurs very rarely[17]. Fig. 6 is an illustration of acute calcifying tendinitis seen on ultrasound as thickened hypoechoic distal biceps tendon with focal calcification and hyperemia in a 22 year old female patient who presented with acute pain in the cubital fossa without any history of previous trauma or surgery.

Bicipitoradial bursitis: Normally, the bicipitoradial bursa is flattened and not visualised with ultrasound or MRI. Distension of the bursa may occur due to bursitis caused by repetitive

trauma or overuse, inflammatory conditions such as rheumatoid arthritis and infection; or in association with partial tendon tear and tendinosis[2,18]. It is seen as a fluid filled structure aound the distal biceps tendon on ultrasound and MRI (Fig. 7). It could compress the radial nerve and less commonly the median nerve causing neural symptoms.

Images for this section:

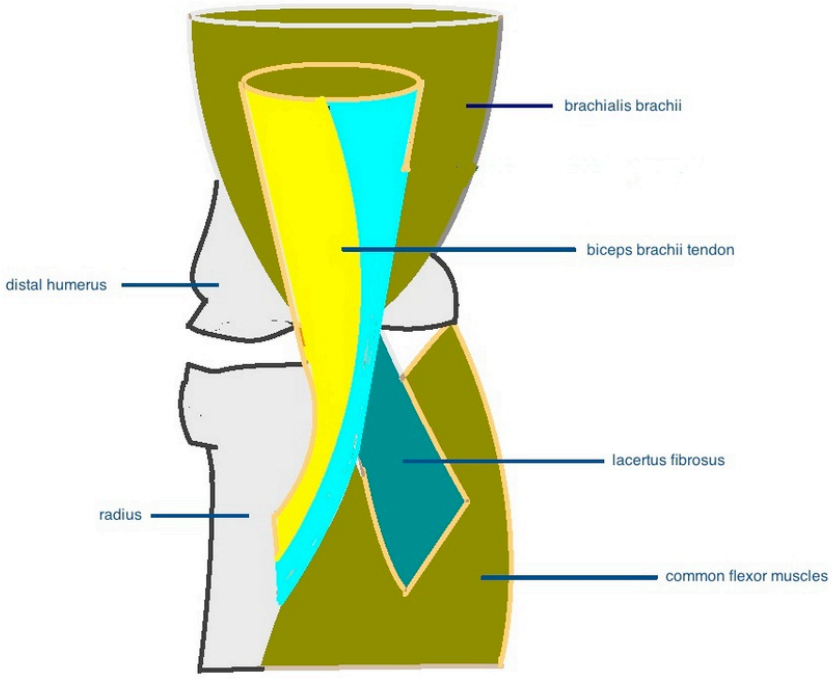

Fig. 1: Schematic drawing illustrating certain anatomical peculiarities of distal biceps tendon. Two separate tendons may exist, one for the short head (blue) and one for the long head (yellow) of biceps brachii. Lacertus fibrosus is a thin fibrous structure arising from the musculotendinous junction extending medially and blending with the fascia of the forearm. The distal biceps tendon has no tendon sheath. Bicipitoradial bursa (not shown here) lying between the biceps tendon and the radius minimises friction during pronation movement of the forearm.

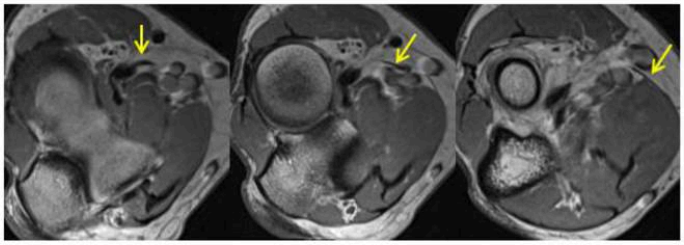

Fig. 2: Lacertus fibrosus: PD weighted axial MR images from proximal to distal: A thin fibrous structure (yellow arrow) is seen arising from the distal biceps brachii tendon and extending medially and finally blending with the fascia of the forearm. Lacertus fibrosus, when intact may prevent retraction of the ruptured biceps tendon.

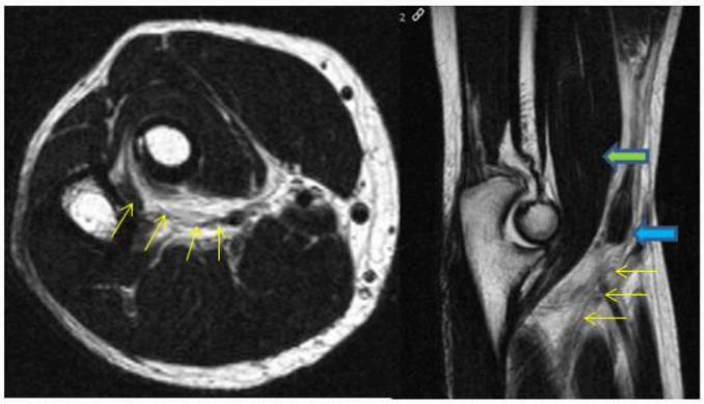

Fig. 3: T2 weighted axial and sagittal MR images show complete rupture of distal biceps tendon. Yellow arrows point to the absence of the biceps tendon along its normal course; blue arrow shows the proximally retracted stump of the ruptured tendon. Green arrow shows the normal brachialis brachii muscle.

Fig. 4: Partial rupture of distal biceps brachii tendon: Sagittal PD weighted MR image shows the distal biceps brachii tendon (green arrow). The portion of the tendon just before the insertion is thickened and shows increased signal intensity (yellow arrow). A hematoma, in the form of intermediate signal fluid collection, is present around the tendon.

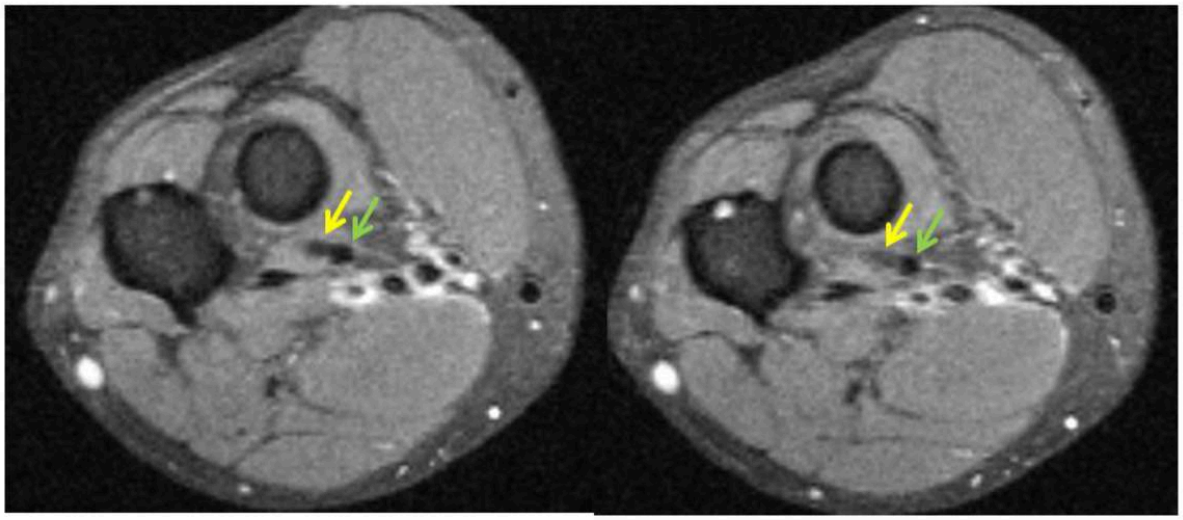

Fig. 5: Tendinosis in the long head tendon of biceps brachii: Two consecutive axial PD weighted images at a proximal and distal level respectively demonstrate separate tendons for the long (yellow arrow) and the short head (green arrow) of biceps brachii - a normal anatomic variant. Increased signal intensity is seen only in the long head tendon; whereas the signal intensity of the short head tendon is maintained. Differentiation between tendinosis and partial tear of the tendon is often difficult as both conditions have similar imaging features and the two conditions may co-exist.

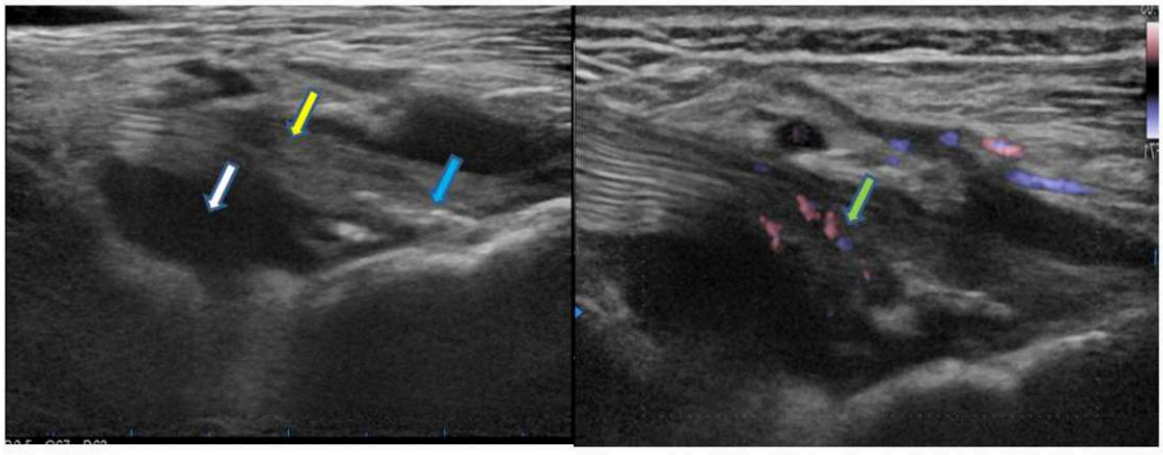

Fig. 6: Calcific tendinitis: Ultrasound images of distal biceps brachii tendon (yellow arrow) in a 28 year old patient presenting with acute pain in anterior elbow without history of trauma or prior surgery. Findings typical of calcific tendinitis are noted: slightly thickened, hypoechoic tendon with multiple foci of calcification (blue arrow) associated bicipitoradial bursitis (white arrow) and hyperaemia due to inflammation (green arrow) on colour doppler image.

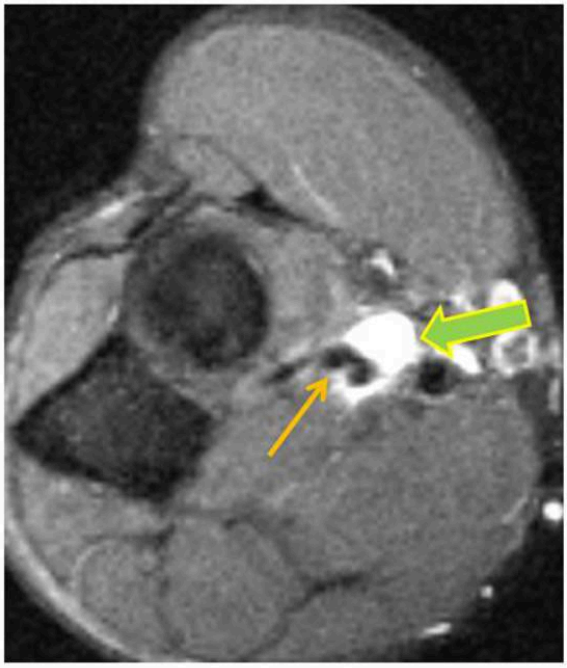

Fig. 7: Bicipitoradial bursitis: PD-weighted axial MR image showing bicipitoradial bursa (green arrow) distended with fluid surrounding the distal biceps brachii tendon. Note two separate tendons for the short head and the long head of the muscle(yellow arrow). The tendon itself was intact and showed normal signal intensity.

Conclusion

Certain anatomical characteristics of the distal biceps brachii tendon such as presence of two independent muscle bellies, short and long head inserting through two separate tendons on the radial tuberosity should be kept in mind to avoid diagnostic errors. Ultrasound and MR are best imaging modalities for evaluating pathologies of distal biceps brachii tendon.

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