Disorders of the biceps and triceps tendons at the elbow

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Abstract

Rupture of the distal biceps and triceps tendons are uncommon injuries but they are becoming increasingly recognised. Conservative management may result in functional deficit, especially in young active patients undertaking manual occupations. There is a consensus that operative management results in an excellent outcome. The optimal approach and technique used remains controversial. This article reviews the epidemiology, anatomy, biomechanics, aetiopathogenesis, diagnosis and current management trends as well as reported outcomes for ruptures of the distal biceps and triceps tendons.

Keywords biceps tendon; tendon repair; tendon rupture; triceps tendon

Introduction

Distal biceps and triceps injuries are uncommon and as a result, the majority of published data are just case series. The opinions on treatment have changed over the last 20 years with the majority advocating operative management. This has led to a number of newly developed techniques but so far there is limited evidence as to which provides the best outcome. In this article we review the epidemiology, anatomy, biomechanics, aetiopathogenesis, diagnosis and current management trends as well as the reported outcomes for ruptures of the distal biceps and triceps tendons.

Biceps tendon

Biceps anatomy and biomechanics

The biceps-brachii muscle is a two headed bi-articular muscle spanning the shoulder and elbow. It originates proximally from the coracoid process of the scapula via its short head and from the supra-glenoid tubercle via its long head. Both tendons converge at the mid-point of the humerus forming a single muscle belly which inserts distally onto the radial tuberosity via its terminal tendon. The terminal tendon is a flat tendon which arises 7 cm proximal to the elbow joint and courses posterolaterally through the cubital fossa to its insertion.[1] In doing so, it also rotates externally through 90°. The cubital fossa (Figure 1) is a triangular region bounded superiorly by an imaginary line running between the distal humeral epicondyles, medially by pronator teres and laterally by the brachioradialis muscle. Its contents from medial to lateral are the median nerve, brachial artery (which bifurcates into the radial and ulnar arteries in the fossa), biceps tendon, and the radial nerve. The floor is formed by the brachialis and supinator muscles and its roof is formed partly by the lacertus fibrosus. The lacertus fibrosus is a continuation of the biceps muscle fascia which blends with the deep fascia of the forearm. Dissection within the cubital fossa for biceps tendon repair requires a thorough understanding of anatomical variants. A recent anatomical study investigating the vascular variations around the distal biceps found that in the majority (76%) of cases the radial recurrent artery passed anterior to the tendon, although it did occasionally pass posteriorly. The artery can be expected to be found between 19 mm proximally and 4 mm distally of the proximal aspect of the radial tuberosity.[2] The 90° rotation of the distal tendon before its insertion allows it to attach onto the most ulnar aspect of the radial tuberosity and in doing so forms a large footprint averaging 21 mm in length and 7 mm in width (Figure 2).[3] Various repair techniques have tried to recreate its insertion with the hope of restoring normal muscle kinematics.

The biceps is the main supinator of the forearm but also aids in flexion. It is most effective as a supinator when the elbow is flexed. It is most effective as an elbow flexor in a supinated forearm and then in a mid-prone position and not at all with the forearm fully pronated. Few studies have looked at the strength properties of the distal biceps tendon. Idler reported a mean failure strength of 204N.[4] Shukla et al more recently suggested

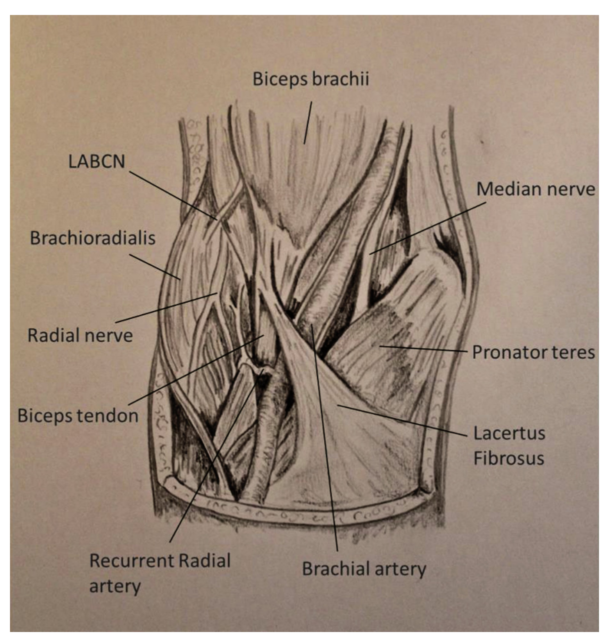

Figure 1 Cubital fossa anatomy.

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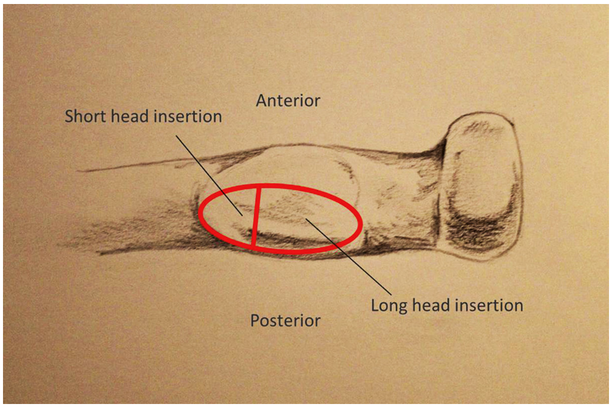

Figure 2 Bicipital footprint.

the load to failure of the biceps tendon may be higher than that initially proposed. This study also found a trend for increasing resistance to failure from moving from 90 to 30° of flexion.[5]

Epidemiology

Rupture of the distal biceps is an uncommon injury. It was first reported by Starks in 1843.[6] Gilcreest stated that it accounted for only 3% of biceps injuries with long head rupture accounting for 96% and short head 1%.[7] The incidence has been reported as 1.2 per 100,000 each year and usually affects the dominant limb.[8] These injuries are more commonly seen in middle aged men aged 40–60,[8] with only a few reported cases in women.[9] There has been a second older group with degenerative tears identified.[10] The cumulative incidence of bilateral rupture is 8%.[11]

Aetiopathogenesis

The majority of tendon ruptures occur during forced extension of a flexed elbow resulting in sudden eccentric contraction of the biceps. The majority are direct avulsions from the radial tuberosity, although musculotendinous junction ruptures have been reported.[12] A combination of predisposing factors has been suggested. These include tendon degeneration, impingement, and avascularity. An anatomic study by Seiler et al found that the principle blood supply to the distal portion of the biceps tendon was from the posterior interosseous recurrent artery. They identified an area of hypovascularity of mean length 2.14 cm just proximal to this distal vascular region. They also showed that the space between the radial tuberosity and ulna within which the tendon lies is 48% narrower in full pronation compared with supination suggesting impingement as a possible aetiological factor.[13] The risk of tendon rupture is 7.5 times greater in smokers and anabolic steroid use has also been implicated.[8]

Clinical examination and diagnosis

Patients will often describe a “pop” or tearing sensation with sudden pain on the anterior aspect of the elbow having tried to catch or lift a heavy object. They may thereafter experience pain or weakness on elbow flexion and supination or fatigue with rotational movements such as using a screwdriver. Examination may reveal swelling of the forearm with bruising commonly tracking across its anteromedial aspect. A “Popeye sign” (often referred to as the “reverse popeye”) may be evident due to retraction of the biceps muscle belly proximally in the upper arm. This should not be confused with the identically named sign caused by long head of biceps rupture where part of the muscle belly descends distally in the upper arm. The most sensitive and specific test described (100% for each) is the “Hook Test.”[14] In this test the examiner attempts to place the index finger under the tendon from the lateral side while the patient actively supinates the flexed elbow (Figure 3). The integrity of the lacertus fibrosus has an impact on the degree of distal tendon retraction. The “bicipital aponeurosis flex test” has been shown to be 100% sensitive and 90% specific in determining its integrity.[15] This test is undertaken by asking the patient to make a fist and actively flex the wrist with a supinated forearm. This contracts the forearm flexors and tensions the lacertus fibrosus. The patient then flexes the elbow to 75° and the sharp edge of an intact lacertus fibrosus can be felt medially in the cubital fossa.

Imaging can be useful in obtaining a diagnosis as well as determining the anatomy. This is especially important in cases with a delay in presentation. The most commonly used imaging modalities are ultrasound (US) and magnetic resonance imaging (MRI). Ultrasound is less expensive than MRI. It is also easier to obtain a comparison with the contralateral elbow and can be used for dynamic imaging. Identification of the tendon at its insertion, however, is less reliable with US than with MRI. MRI scan is useful, especially in partial ruptures. It also has the potential advantage of identifying other pathology around the elbow. The patient position for MRI is usually prone with the arm overhead in the FABS position: flexion of the elbow, abduction of the shoulder and supination of the forearm.[1]

Treatment: non-operative

Non-operative management is still deemed the mainstay of treatment for elderly patients with sedentary lifestyles or those with multiple co-morbidities. Operative fixation is relatively contraindicated in ruptures with delayed diagnosis. In addition, the not-insignificant risk of complication with operative treatment may sway patients toward non-operative management. This usually consists of analgesia and gentle mobilisation. Rupture of the distal biceps tendon often results in pain, weakness and lack of endurance in repetitive elbow flexion or supination. There are a number of reports of poor outcomes with non-op management. Baker and Bierwagen found that their nonoperative group had a reduction in supination strength of 40% and endurance of 79%.[16] Morrey et al found a similar reduction in supination strength of 40% and 30%

Figure 3 Hook test.

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