Sports-Related Injuries of the Biceps and Triceps

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KEYWORDS

• Elbow joint • Biceps • Triceps • Rupture • Reconstruction

The biceps and its antagonist, the triceps, are the main flexors and extensors of the elbow joint. In the athlete they are responsible for accelerating the forearm during throwing or pitching and then decelerating the arm to prevent injury to the elbow joint. Rupture of the biceps or triceps is regarded as a rare injury, but in the authors' opinion the incidence appears to be increasing. Historically, operative repair of the biceps brachii was fraught with difficulty, but in recent times surgical techniques have improved and the results of biceps and triceps repair have improved.[1–10]

BICEPS

Distal biceps tendon ruptures are rare, accounting for only 3% to 12% of all biceps tendon injuries. The reported incidence is 1.2 per 100,000 people, the dominant arm being affected 86% of the time. The average age of patients is 50 years old with an age range of 18 to 72 years of age.[2,5,8,11,12] The most commonly cited risk factors are male gender, smoking, anabolic steroid use, and body building.[11–13] The proposed etiologies are manyfold; the most commonly implicated include an irregularity of the radial tuberosity, radial bursitis, and a watershed area of poor arterial supply.[14–17] Tears within the substance of the tendon or at its musculotendinous junction are rare, with the vast majority of tears occurring at the distal insertion.[18,19]

ANATOMY

Compared with the anatomy and physiology of the proximal end of the biceps muscle, the anatomy of the distal biceps tendon was poorly understood; however, in recent

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years our understanding has improved.[20] Most anatomic descriptions have suggested that the muscle originates as 2 proximal heads that merge at the level of the deltoid tuberosity to form a single muscle belly.[21] In work undertaken by Eames and colleagues,[20] this was not found to be the case. In 10 of 17 specimens they dissected, they found that the short head (originating from the coracoid process) and the long head (originating from the superior lip of the glenoid) continued along their entire length as separate muscles. Each muscle was surrounded by loose epimysial tissue and the short head remained on the ulnar side of the arm throughout its course, with the long head running parallel to it. In the remaining 7 specimens there was varying amounts of interdigitation of the muscle into a raphe in the distal third of the muscle bellies. This interdigitation is usually easily separated with the gloved finger.

At the level of the lacertus fibrosus, the tendons continue in line with their respective muscle bellies and may be separate or fuse into one structure. If the tendons do combine, they are still easily dissected into their separate bundles. The lacertus fibrosus itself arises at the level of the musculotendinous junction. It consists of 3 layers, which are postulated to play a role in stabilizing the tendon distally.[20,22]

The long head tendon inserts onto the prominence of the radial tuberosity. The short head attaches more distally onto the shaft of the radius. It is interesting to note the position of the two insertions relative to the axis of forearm rotation, which extends from the center of the capitellum to the center of the head of the ulna. By inserting into the prominence of the radial tuberosity, the long head of biceps positions itself at the maximum distance that the radius extends from the axis of rotation of the forearm, thus providing maximal rotatory torque. The short head inserts predominantly along the line of the center of rotation of the forearm, thereby providing greater flexion leverage and a reduced rotation torque.[20]

Eames and Bain[20] further divide the distal biceps tendon into 3 zones:

Zone 1, *preaponeurosis*: a variable amount of muscular interdigitation of the two bellies occurs, with many cadavers showing none at all.

Zone 2, *aponeurosis or lacertus fibrosus*: the lacertus fibrosus consists of 3 layers and has a wide and deep involvement in the flexor compartment of the forearm; it completely encircles the flexors and has fascial attachments particularly to the ulnar flexors, and incorporates the median nerve and brachial artery.

Zone 3, *postaponeurosis*: the two tendons continue distally past lacertus fibrosus and insert onto the radial tuberosity.

Etiology

Local degenerative and pathologic changes are thought to be a factor in the etiology of acute ruptures of the distal biceps tendon. These changes include hypertrophic changes of the radial tuberosity,[14,17] which lead to abrasion of the tendon during rotatory movements and biceps bursitis.[23] Theories have also included hypovascularity of the tendon adjacent to the insertion of the radial tuberosity.[17] When the forearm rotates, the space between the radius and ulna is narrowed, which could abrade or compress the biceps tendon during the repeated forearm rotation.[8,14] Synovitis or osseous lipping can narrow this gap resulting in compression and direct attrition of the tendon. As with other tendons, anabolic steroid use among body builders has also been implicated in acute biceps tendon rupture, but body building in isolation is also thought to be a risk factor. There is a higher incidence of distal biceps tendon rupture in males, but this statistic may be biased because of the higher rates of men being employed in occupations involving heavy lifting. It is also thought that there is a higher incidence in smokers. The dominant arm is affected 86% of the time.[12]

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