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UPPER LIMB

Treatment of the painful biceps tendon—Tenotomy or tenodesis?

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Summary
The function of the long head of biceps tendon in the shoulder remains controversial. Pathology of the biceps tendon such as tenosynovitis, subluxation and pre-rupture are intimately associated with rotator cuff disease. Treatment therefore varies widely among surgeons and range from non-operative management to biceps tenotomy or tenodesis. The purpose of this article is to provide an up to date review on the indications and results of biceps tenotomy and tenodesis.

Anatomy

The anatomical origin of the long head of biceps tendon is variable. It arises most commonly from the glenoid labrum (45%), less commonly from the supraglenoid tubercle (30%) and in the remaining it arises from both the glenoid labrum and the supraglenoid tubercle (25%). The tendon travels obliquely within the glenohumeral joint to exit beneath the transverse humeral ligament along the intertubercular sulcus or bicipital groove. In the glenohumeral joint the tendon is encased within a synovial sheath, which ends as a blind pouch at the end of the bicipital groove. As a result, the biceps tendon is intraarticular but extrasynovial.

The average length of the tendon is 102 mm. It is interesting to note that the shape and cross-sectional area of the tendon changes as it runs from proximal to distal. At its proximal attachment near the glenoid, it has an average cross-section of 8.4×3.4 mm. This decreases to 4.5×2.1 mm as the tendon leaves the bicipital groove. Therefore, rupture of the biceps tendon most commonly occurs proximally near the glenoid labrum and distally in the bicipital groove.

Function

The biceps muscle-tendon unit is one of many structures in the human body to cross two joints. In the elbow, it serves primarily as a forearm supinator. Its secondary role is as an elbow flexor. Whilst its function at the elbow is clear, its role in the shoulder joint remains controversial. Cadaveric studies[1–3] suggest that the long head of biceps acts as a humeral head depressor, anterior stabiliser, posterior stabiliser, limiter of external rotation, lifter of the glenoid labrum as well as a humeral head compressor. Warner[4] studied the change in acromiohumeral interval on plain radiographs in patients with isolated loss of the proximal attachment of the long head of biceps. He found that there was 2–6 mm of superior translation of the humeral head in all patients in all positions of shoulder abduction except at zero degrees. He concluded that the long head of biceps acts

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as a stabiliser of the humeral head in the glenoid during shoulder abduction in the scapular plane. The most recent biomechanical data come from Youm et al.[5] who found that loading of the long head of biceps tendon significantly affects the glenohumeral joint range of movement, translations and kinematics. They concluded that the long head of biceps acts as a ligament at the extreme of motion to shift the humeral head to a position more centred on the glenoid.

Electromyographic studies[6–8] have produced conflicting results. There have been seven studies confirming that the long head of biceps acts as a shoulder flexor, three studies supporting its role as a shoulder abductor, two for internal rotator, one for external rotator and one as a shoulder extensor, one as anterior stabiliser of the shoulder and one study showing that it has abductor function only with resistance. A common limiting factor in all these studies is that the electromyographic activity from the motion of the elbow and forearm was not controlled during measurement of shoulder activity. Levy et al.[6] have controlled this variable using a long arm brace, locking the elbow in extension and forearm in a neutral position. They concluded that the long head of biceps is not active in isolated shoulder motion when the elbow and forearm are controlled. They postulated that activity of the biceps tendon in the shoulder is achieved by either passive proprioception of the tendon or by active tension in association with the elbow and forearm activity.

It seems evident therefore that the long head of biceps does not have a primary function in the shoulder but instead has multiple secondary roles. It is hardly surprising, therefore, to know that there is no single reliable clinical test to diagnose biceps pathology, as there is no primary function that can be isolated.

Pathophysiology

Pathology of the biceps tendon can be broadly divided into three main types: inflammatory, instability and traumatic. Clearly, there is a huge overlap between these categories and in fact biceps pathology is very rarely a single entity (Fig. 1). The pathology most commonly seen is biceps tenosynovitis associated with a rotator cuff tear. This is related to its anatomical arrangement, since the biceps tendon sheath is continuous with the synovium of the glenohumeral joint and therefore any inflammatory process affecting the rotator cuff is likely to affect the long head of biceps as well. Hence, the detection of fluid in the biceps sheath on ultrasound is highly sensitive for rotator cuff disease.

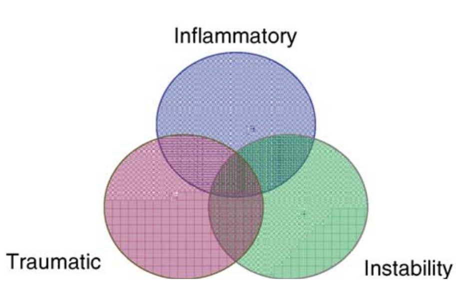

Figure 1 There is often an overlap between different pathologies of the biceps tendon.

Primary versus secondary biceps tendinitis

Primary biceps tendonitis, in which there is isolated pathology affecting the tendon, is rare. One of the few studies that supported the existence of primary biceps tendonitis comes from Berlemann and Bayley[9] who reported the long term results of 14 patients (15 shoulders) following keyhole biceps tenodesis. Fifty-three percent of patients had previously undergone a subacromial decompression but symptoms persisted until the biceps tenodesis was carried out. This would suggest that biceps tendinitis is a primary event. Other researchers, however, believe that biceps tendonitis is secondary to an ongoing subacromial impingement.[10,11] Since the biceps tendon occupies a relatively antero-superior location within the impingement zone, it is prone to mechanical impingement. Neer[10,11] believes that 95% of biceps tendonitis is secondary to impingement. Neviaser[12] has also reported that there is a strong association between rotator cuff tear and biceps tendonitis. In a large series of 210 patients with impingement, Walch[13] found that 70% had concomitant biceps pathology. This is supported by another large series of 200 patients by Murthi et al.;[14] 49% had evidence of biceps pathology and 40% required subsequent tenodesis.

Treatment

The treatment of biceps tendonitis remains controversial. Spontaneous rupture of the long head of biceps is very common but is seldom associated with any significant long term functional deficits. Mariani et al.[15] compared 30 patients with spontaneous rupture of the long head of biceps treated non-operatively with 26 patients who underwent early biceps tenodesis. They found that there was a loss of 21% of supination strength in the group treated non operatively compared to 8% in the tenodesis group. There was no difference in elbow flexion strength but the group treated non-operatively returned to work earlier.

It seems therefore that spontaneous rupture of the long head of biceps tendon can be treated adequately without surgery (Fig. 2). In the context of rotator cuff disease, treatment of the degenerate biceps tendon is more controversial. Surgical options include benign neglect with treatment of concomitant rotator cuff disease only, inspection and synovectomy, repair of partial tear, tenotomy and tenodesis. Proponents for biceps tenotomy advocate that the procedure is simple to do, has limited surgical morbidity, bears no postoperative restriction, avoids implant complications such as hardware loosening, tendon pull-out, bicipital spasm etc.[12,15] Moreover, most patients requiring this procedure are elderly with low functional demand.

One of the largest studies of the results of biceps tenotomy comes from the data in Lyon by Walch et al.[13] Between 1988 and 1999, he carried out 390 biceps tenotomies for full thickness rotator cuff tear. The cuff was not repaired but 35% of patients did have a subacromial decompression. After a mean follow up of 57 months, the mean Constant score improved from 48 preoperatively to 67