Anomalous biceps origin from the rotator cuff

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ABSTRACT
Variations in the origin of the long head of biceps tendon (LHBT) have been described in literature; however, its clinical significance remains uncertain. We describe in this report, the history, physical examination and the arthroscopic findings in a patient who had an anomalous origin of the LHBT from the rotator cuff, resulting in restriction of range of motion. This anomalous origin of the long head of biceps tendon causing capsular contracture and restriction of movements leading to secondary internal impingement, has not been extensively reported in the literature. Shoulder arthroscopists should be aware that, although, an uncommon clinical condition, the aberrant congenital origin of the LHBT from the rotator cuff can rarely become pathologic in middle age and lead to shoulder dysfunction. In such cases, release of the anomalous band may be required, along with the treatment of other concomitant intraarticular pathologies in the glenohumeral joint.

Key words: Anomalous, biceps, impingement, rotator cuff
MeSH terms: Shoulder impingement syndrome, rotator cuff, tendons

INTRODUCTION
The long head of the biceps tendon (LHBT) is known to originate from the superior glenoid tubercle. After its origin, the LHBT traverses the glenohumeral joint (intraarticular part) and the inter tubercular sulcus (extra articular part) before becoming a musculo-tendinous structure. However, a number of authors have reported substantial variations in its origin.1-4 Early fetal studies have found that the LHBT and the glenoid labrum develop from a loosely organized layer of cells around the shoulder joint.5,6 This cellular layer also gives rise to the synovial membrane, joint capsule and the subscapularis muscles. These embryological origins may explain some of the variations in the attachment of the LHBT.1-4 In a cadaveric study of 105 fresh frozen shoulders of both sexes from 3rd to 9th decade, it was found that in 50% of cases, the LHBT originated from the supraglenoid tubercle and the rest from the superior labrum, with most of the origin reported to develop from the posterior aspect of the labrum.7

A number of anatomic variations in the origin of LHBT have been reported in literature, such as supernumerary heads, bifurcated origin from the supraglenoid tubercle and posterior labrum, capsular origin, aberrant intraarticular origin from the rotator cuff, and split tendon from a single origin. However, these variations are seldom observed in clinical practice. Nevertheless, when unexpectedly found, it is often considered to be an isolated entity, which is unrelated to any concomitant shoulder pathology.

The purpose of this report was: (1) to report the rare occurrence of an aberrant thickened fan shaped origin of the LHBT from the under surface of the rotator cuff in a patient who presented with antero lateral shoulder pain and stiffness; and (2) to report that an aberrant origin of the LHBT from the rotator cuff can become pathologically thickened and cord like in middle age from a limited inflammatory process and present in a delayed fashion, potentially causing selective capsular contracture and secondary impingement in the shoulder.

CASE REPORT
A 49-year-old female patient, who had right hand dominance, presented to the shoulder service at our institution with a history of painful restriction of movement of her right shoulder of several years duration. The pain was intermittent, localized to the front and top of her shoulder,
dull aching in nature, increased to 6/10 in intensity with lifting and decreased to 0/10 with rest and medications. There was no previous history of trauma or injury to her shoulder. She had tried physical therapy without any substantial benefit.

On physical examination, there was no wasting or tenderness around the symptomatic shoulder. Active pain free range of movements of the right shoulder (compared with the left) were 120° (180° on the left shoulder) of forward elevation, 40° (65° on the left shoulder) of external rotation, with the arm in adduction, 45° (90° on the left shoulder) of external rotation with the arm in the abduction and 45° (85° on the left shoulder) of internal rotation with the arm in forward flexion suggestive of predominant anterosuperior and posteriorsuperior capsular contracture. The patient experienced pain on passive elevation beyond 120° and further elevation to 160° was possible. She experienced a painful arc of 40-120°, although further abduction was not restricted in the coronal plane. Tests for acromioclavicular joint irritability or labral tears were negative. Hawkins and Neer’s sign for impingement were however, found to be positive. Rotator-cuff muscle strength was comparable to the opposite side and neurological examination was found to be noncontributory. Plain radiographs of her right shoulder were normal. The Oxford shoulder score at this visit was 26 points.

On repeating the tests for shoulder impingement following a subacromial injection of local anesthetic, the anterolateral shoulder pain was significantly reduced. The pain free range of motion (ROM) improved, but the overall ROM remained unchanged. On the basis of these findings, a clinical diagnosis of subacromial impingement with secondary capsular contracture was made and the subacromial space and the gleno-humeral joint were injected with 40 mg of depot preparation of methyl prednisolone each, after explaining the risks and benefits. She was further advised to undergo regular physical therapy for the next 6 months to specifically address the anterior and posteriorsuperior capsular contracture. One year later, she still complained of marked shoulder pain, with only marginal improvement in the shoulder stiffness, which prevented her from carrying out activities of daily living. Her Oxford shoulder score was 30 points at her second visit. At this stage, the patient opted for arthroscopic surgical treatment after a thorough discussion of the risks and benefits of continued conservative treatment versus operative intervention.

On examination under general anesthesia, the ROM corroborated with the findings on physical examination. An arthroscopy of the shoulder was planned. The patient was placed in left lateral decubitus with the affected arm in 20° abduction and 15° forward flexion for the arthroscopy. Standard posterior, lateral and anterior portals were established. During the arthroscopic examination the capsule and synovium was found to be healthy without any signs of inflammation. An aberrant fan shaped thickened band from the proximal 1/3rd of the LHBT was seen extending to the under surface of the anterior 1/3rd supraspinatus tendon [Figure 1]. The distal 2/3rd of the intra articular portion of the LHBT was seen to be of normal size and orientation without any evidence of degeneration or deformity. This anomalous band was felt to be a cord-like structure and was seen to be visibly taut and resisting further movement beyond 15-20° external rotation in 40°-55° forward flexion respectively. The aberrant biceps was also seen to be tightening on the abduction of 60-75° and internal rotation beyond 30° respectively. Although accurate evaluation of extremes of glenohumeral motion are difficult during arthroscopy, we did not see any problems in measuring glenohumeral motions at these ranges with the arm out of traction. The biceps pulley was found normal. The glenoid labrum was found to be intact without any evidence of superior labrum, anterior posterior (SLAP) lesion. The main biceps tendon was seen firmly attached to the superior labrum.

The articular cartilage over the glenoid and humeral head, the rotator cuff insertion, the subscapularis tendon, superior gleno-humeral ligament and middle gleno-humeral ligament appeared normal [Figure 2]. The rotator interval did not show any evidence of inflammation or thickening. Bursoscopy revealed a tight subacromial space with moderate prominence of anterolateral acromion. Some fraying of the rotator cuff on the bursal side and scuffing of the coraco acromial ligament was also seen. An arthroscopic anterior acromioplasty with detachment of the coraco acromial ligament from the anterior acromion was performed. Full thickness of the acromion anterior to the acromio clavicular joint was resected with a 5 mm shaver blade. The under surface of the anterior acromion was rendered flat with a shaver through the posterior portal and the lateral edge of acromion was beveled.

Figure 1: An arthroscopic view: White arrow showing anomalous bifurcated origin of the proximal portion of the long head of biceps tendon from the under surface of the supraspinatus tendon and the black arrow showing its attachment to the superior labrum.
Attention was then directed to the intraarticular aberrant anatomy. Since the anomalous attachment of the LHBT was found to be contributing to the restriction of external rotation in abduction a decision was taken to proceed with tenolysis of the LHBT prior to release of the rotator interval or capsular release. The aberrant attachment of the LHBT was completely released and freed from the rotator cuff with a radiofrequency wand [Figure 3]. Restoration of free and full rotation and elevation was achieved following the release which was confirmed by removing the arm from the traction and checking the ROM. A formal capsular and rotator interval release was thus, felt unnecessary at this stage.

Postoperatively, the patient was advised to actively mobilize her shoulder as soon as she was comfortable. She was also advised to start a program of active and passive stretching exercises to achieve full elevation, external and internal rotation under the guidance of the physical therapists. There were no postoperative complications. At 12-months followup, her Oxford Shoulder score was 47 points (maximum 48 points, minimum 12 points) and she regained full pain free ROM in all directions with no symptoms or signs of gleno humeral instability.

**DISCUSSION**

Although multiple variations in origin of LHBTs have been published in embryology and anatomy, they are less often observed in clinical practice with reported incidence up to 7.4% in one study. Moreover, when these variations do occur, their precise role in development of various shoulder pathologies are often debated upon. The purpose of this report was to report a case of anomalous LHBT originating from the rotator cuff, which potentially contributed to the development of capsular contracture and secondary internal impingement.

Some authors, mostly in single case reports, have reported that aberrant origin of the LHBTs may be causally related to a number of conditions such as rotator cuff degeneration, instability, impingement, chronic pain and acromio-clavicular arthritis. Wahl et al. in their study of 3 patients with LHBT anomalies, reported that one patient presented with a painful Type 2 SLAP tear associated with a band like fibro synovial thickening extending from the intra articular portion of the LHBT to the under surface of the supraspinatus. The authors believed that the anomalous LHBT may have been causally related to the SLAP lesion, as excision of the fibrotic band led to complete resolution of symptoms, at final followup of 9 months. They classified the anomalous LHBT into 5 types normal (N), incomplete proximal mesenteric (M/p), incomplete distal mesenteric (M/d) and complete mesenteric (M/c) and absent (x). The fan shaped band found in our patient was similar to the incomplete mesenteric type (M/p) of aberrant long head of biceps (LHB). Similarly, Kanatli et al., in a series of 50 patients, with LHB anomalies, reported a significantly higher incidence of superior labral and Bankart’s lesions in patients with these anatomical variations compared with a population who did have this aberration (32% vs. 13%; P < 0.001). The authors reported a 14% (1 out of 7 patients) incidence of superior labral anterio-posterior lesions in patients with a similar proximal capsular aberrant attachment of the LHBT.

However, other authors believe that congenital absence of the LHBTs may be more causally related to the development of shoulder instability and other pathologic conditions, rather than developmental anomalies with no clinical consequences. Wittstein et al., in their report of 2 patients, found that anomalous origin of LHBT from rotator cables were unrelated to shoulder pathologies and believed that treatment of the primary diagnoses were
sufficient for resolution of symptoms. Similarly, Kim et al. in their study have reported a BARC anomaly in a 52-year-old patient presenting with pain and restriction of movement. A bursal side partial thickness tear of the infraspinatus tendon was found during the arthroscopic examination. The cuff tear was repaired without addressing the aberrant LHBT, since it was not believed to be contributing to the symptoms. The patient had regained full ROM without any symptoms at 23 months followup. However, the authors acknowledged that recognizing insertional abnormalities in the biceps tendon is important since it can be a source of shoulder pain either alone or in combination.

Gramstad et al. in a cadaveric study found that the tension in the LHBT was increased significantly with humeral rotations in the coronal and sagittal plane. The results of this study may suggest that abnormal origin of the long head of biceps tendon may potentially lead to restriction of range-of-motion due to alterations in the functional length of the tendon. Although it is difficult to be absolutely certain that adhesive capsulitis didn’t give rise to adhesions or a band between the cuff and the long head of biceps tendon in our report, the lack of arthroscopic evidence of capsular, axillary pouch, or rotator interval thickening and restoration of movements after surgical release provides evidence that the mesenteric band was possibly congenital in origin. One possible explanation for delayed presentation of a congenital band of long head of biceps tendon could be that a local adhesive capsulitis-like inflammatory process during middle age, may have led to thickening, reduction in functional length and loss of elasticity of an original, flimsy and nonpathologic elastic band leading to restriction of movement. This may have caused a tenodesis effect leading to selective posterior and superior capsular contracture and secondary internal impingement. Thus, a subacromial decompression with the release of the thickened band was considered to address each pathological entity separately.

Since there are very few cases of anomalous origin of the long head from the rotator cuff reported in literature and still fewer cases, reported clinical symptoms attributed to this anomaly, definite conclusions about its pathologic nature are difficult to construe. Due to the rare nature of these lesions, it is unlikely that a substantial sample size will be generated in future to propose treatment recommendations. Nevertheless, shoulder arthroscopists should be aware of its potential to become abnormally thickened and pathologic causing shoulder dysfunction. It is impossible to concur from an isolated case report that marsupialization remains the sole cause for pain relief, especially when a subacromial decompression was performed simultaneously. However, release of mesenteric attachments may be considered in patients with abnormally thickened aberrant LHBTs who present with clinical symptoms of pain and restriction of pain and movement following failure of conservative methods and surgical treatment of all associated shoulder pathologies.

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