Technical Note

Arthroscopic In Situ Biceps Tenodesis Using a Double Loop-and-Tack Knotless Suture Anchor

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Abstract: The long head biceps tendon is a common culprit of anterior shoulder pain and dysfunction that can be surgically treated with tenotomy or tenodesis. Many techniques exist for tenodesis. This article submits an arthroscopic technique using two loop-and-tack sutures and a knotless suture anchor to tenodese the long head biceps tendon in the proximal bicipital groove in situ. The advantage of this technique is that it maintains the biceps in its native position by performing tenodesis before tenotomy. Most other techniques attempt to restore native position of the biceps through approximation. The transverse humeral ligament is also released to decompress the bicipital groove. This technique can be used to treat isolated biceps pathology or combined with rotator cuff and labral procedures.

Introduction

The function of the long head biceps tendon (LHBT) is not fully understood; however, LHBT pathology can cause substantial anterior shoulder pain and dysfunction.[1] Common pathologies include tendinitis, partial tear, instability, pulley lesions, and superior labrum anterior to posterior tears.[2−4] If nonoperative management fails, then surgery with either tenotomy or tenodesis is usually recommended.[5] Tenodesis has the advantages of lower incidence of cosmetic deformity and maintaining the anatomical length-tension relationship of the biceps that may reduce muscle spasms and fixation failure.

Various techniques have been described for tenodesis of the LHBT, which differ in approach (open versus arthroscopic), location (intra-articular proximal to the biceps sling versus extra-articular suprapectoral or subpectoral within the bicipital groove), and fixation method (e.g., soft tissue simple suture, polymer versus all-suture anchor, interference screw, bone tunnels).[6−9] To date, no single technique has been shown to be superior. The surgeon should use clinical judgement to select the most effective and reproducible technique that addresses the main goals of 1) maintaining physiological LHBT tension, 2) achieving secure fixation, and 3) removing or decompressing pathologic tissue.

Surgical Technique (With Video Illustration)

Positioning and Arthroscopic Evaluation

The patient is brought to the operating room and transferred onto the operating table. General anesthesia is induced. The shoulder is examined to test range of motion and stability. The patient is positioned lateral decubitus with care to protect neurovascular structures and bony prominences. Beach chair position is an alternative based on surgeon preference. The shoulder is prepped and draped in standard fashion and elevated in 45° of abduction with 10 to 15 pounds of longitudinal traction. Diagnostic arthroscopy is performed through a posterior portal with an anterior portal for instrumentation. A plastic cannula is placed in the anterior portal. The LHBT is inspected using a probe to retract it further into the glenohumeral joint. Anatomically related structures are inspected for pathology, including the biceps sling, origin of the LHBT at the supraglenoid tubercle, superior labrum, anterior aspect of the supraspinatus tendon, and upper border of the subscapularis tendon. Intra-articular

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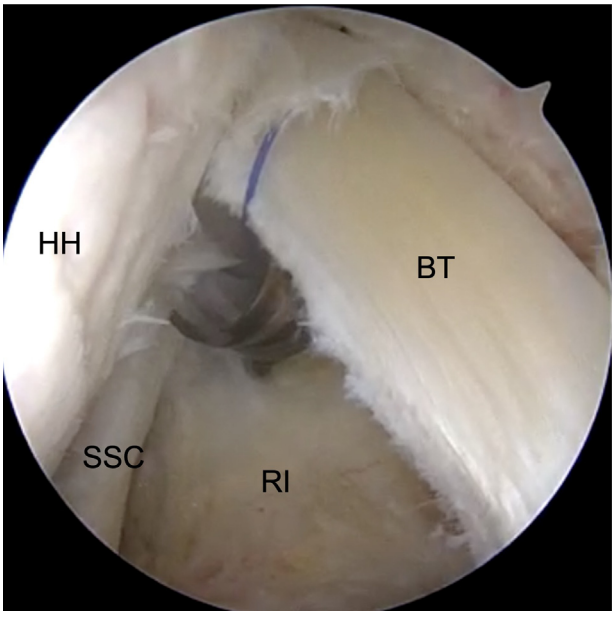

Fig 1. The long head biceps tendon is marked on both sides with #0 Prolene sutures in the glenohumeral joint through the anterosuperolateral aspect of the rotator interval and out through the anterior portal cannula. Glenohumeral view from the posterior portal in a left shoulder in lateral decubitus position. BT, long head biceps tendon; HH, humeral head; RI, rotator interval; SSC, subscapularis.

pathology is addressed as indicated (e.g., labrum or rotator cuff debridement, chondroplasty, removal of loose bodies).

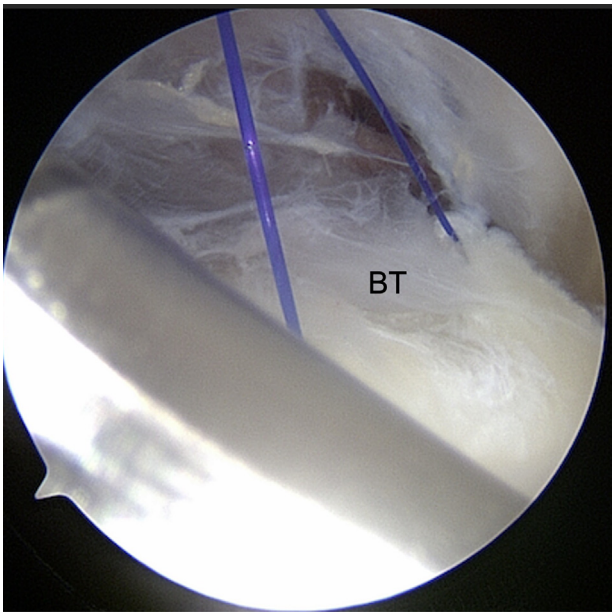

Fig 2. The long head biceps tendon and bicipital groove are localized between the Prolene sutures in the subacromial space. Subacromial view from the posterior portal in a left shoulder in lateral decubitus position. BT, long head biceps tendon.

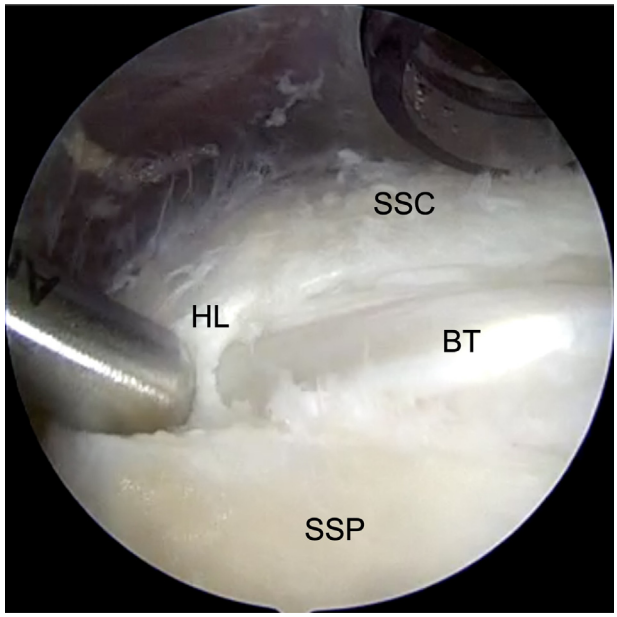

Fig 3. The long head biceps tendon is unroofed, and the transverse humeral ligament is released with a shaver. Subacromial view from the posterior portal in a left shoulder in lateral decubitus position. BT, long head biceps tendon; HL, transverse humeral ligament; SSC, subscapularis; SSP, supraspinatus.

Localization of the Long Head Biceps Tendon

The LHBT is marked on both sides through the rotator interval using two #0 Prolene sutures and an 18-gauge spinal needle (Fig 1). The needle is inserted anterosuperolaterally through the rotator interval. A suture is passed through the needle and retrieved from the anterior portal. The needle is removed before retrieving the suture to avoid inadvertently cutting the suture. A second suture is placed in a similar fashion. The sutures are clamped for ease of handling. Marking the LHBT in this manner helps with finding the LHBT and bicipital groove in the subacromial space. The arthroscope is moved into the subacromial space from the posterior portal. An anterolateral subacromial portal is established. Subacromial bursectomy is performed for visualization using a shaver. A plastic cannula is placed in the anterolateral portal. The bicipital groove is identified by following the space between the two Prolene sutures and directly palpating the LHBT and bicipital groove (Fig 2). The LHBT is unroofed, and the transverse humeral ligament is released using a shaver (Fig 3). A radiofrequency wand is usually needed for hemostasis in this area.

Implementation of Loop-and-Tack Sutures

The anterior portal cannula is moved into the subacromial space through which a tissue grasper is used to elevate the LHBT out of the bicipital groove. Two loop-and-tack sutures (1.3 mm FiberLink SutureTape,

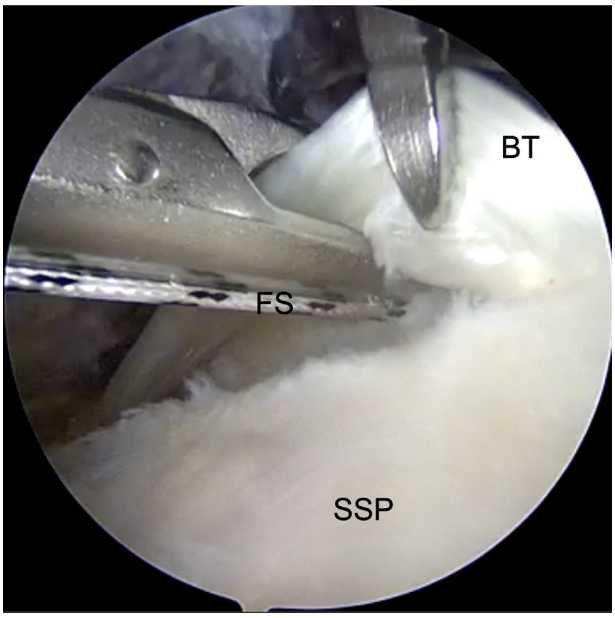

Fig 4. The first loop suture is placed using an antegrade suture passer, while the long head biceps tendon is elevated with a tissue grasper. Subacromial view from the posterior portal in a left shoulder in lateral decubitus position. BT, long head biceps tendon; FS, first suture; SSP, supraspinatus.

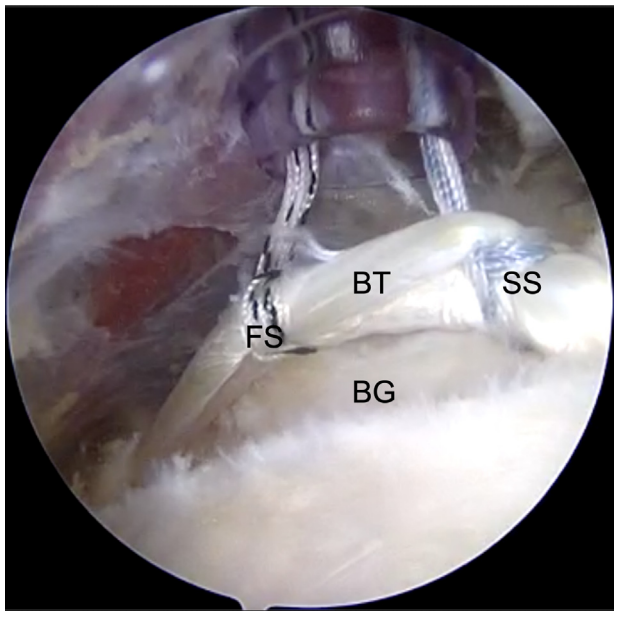

Fig 6. Both loop-and-tack sutures are complete. Subacromial view from the posterior portal in a left shoulder in lateral decubitus position. BG, bicipital groove; BT, long head biceps tendon; FS, first suture; SS, second suture.

Arthrex, Naples, FL) are placed in the LHBT, as follows. Through the anterolateral portal, a suture is passed around the LHBT using an antegrade suture passer (Scorpion Suture Passer, Arthrex, Naples, FL) and cinched in a luggage tag fashion (Fig 4). This suture is retrieved from the anterior portal and used instead of a tissue grasper to elevate the LHBT out of the bicipital groove. A second suture is passed around the LHBT, adequately spaced from the first suture, cinched in a luggage tag fashion, and tacked through the LHBT distal to the loop using an antegrade suture passer (Fig 5). The completed loop-and-tack suture is retrieved through the anterior portal, and the first suture is retrieved through the anterolateral portal. The first suture is tacked through the LHBT distal to the loop using an antegrade suture passer. Both loop-and-tack sutures are complete (Fig 6).

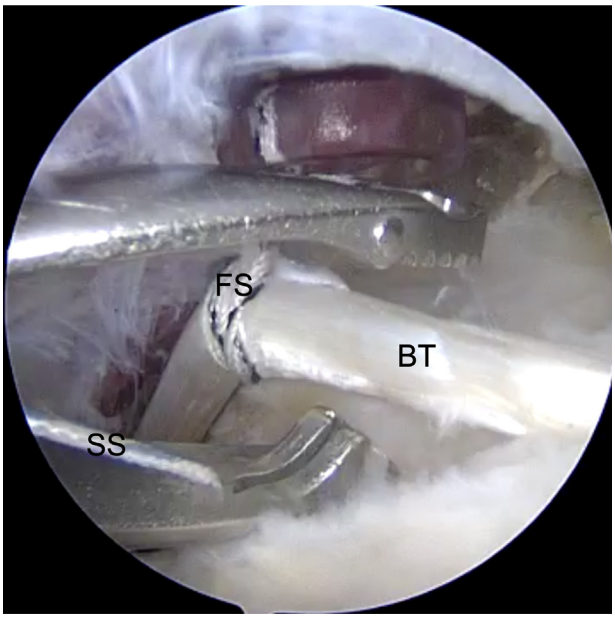

Fig 5. The second loop suture is placed using an antegrade suture passer followed by a distal tack suture (not shown), while the long head biceps tendon is elevated by the first loop suture. Subacromial view from the posterior portal in a left shoulder in lateral decubitus position. BT, long head biceps tendon; FS, first suture; SS, second suture.

In Situ Biceps Tenodesis Followed by Tenotomy

Both sutures are retrieved through the anterior portal and affixed in the bicipital groove with a knotless suture anchor (4.75 mm BioComposite Swivelock, Arthrex) between the two sutures using a punch and tap, as needed, for dense bone (Figs 7 and 8). The suture tails are cut, and the shoulder is rotated to demonstrate secure fixation of the tenodesis (Fig 9). Intra-articular arthroscopy is revisited and the LHBT is released at its origin using arthroscopic scissors, and the proximal stump is debrided using a shaver or radiofrequency ablator (Fig 10). Tenodesis of the LHBT in situ before tenotomy ascertains that physiological tension is maintained. Additional pathology is addressed in the subacromial space as indicated (e.g., rotator cuff repair, acromioplasty, distal clavicle excision).

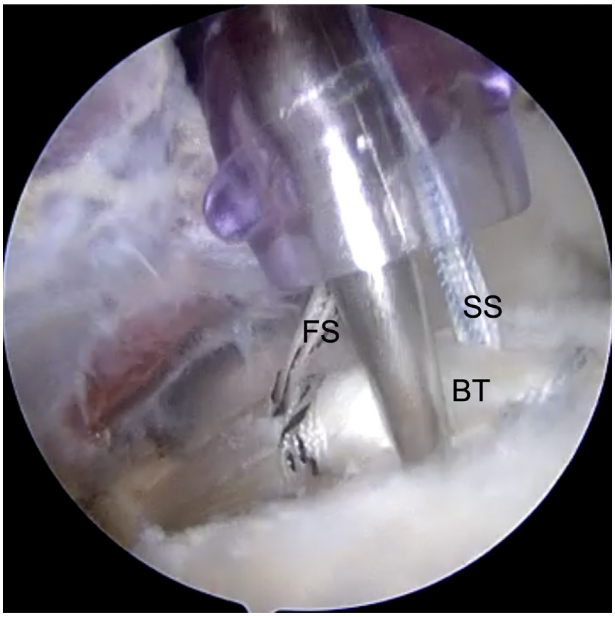

Fig 7. An osseous punch is used to prepare the location of the suture anchor between the two sutures in the proximal bicipital groove. Subacromial view from the posterior portal in a left shoulder in lateral decubitus position. BT, long head biceps tendon; FS, first suture; SS, second suture.

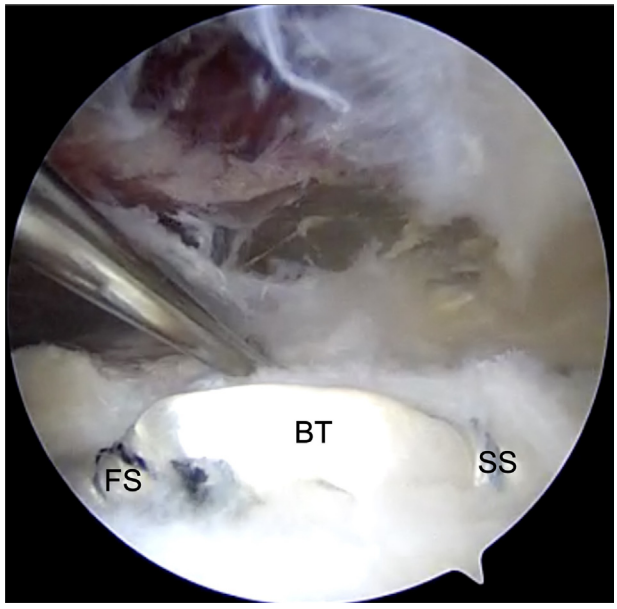

Fig 9. The arthroscopic in situ biceps tenodesis is complete and suture tails are cut. Subacromial view from the posterior portal in a left shoulder in lateral decubitus position. BT, long head biceps tendon; FS, first suture; SS, second suture.

Postoperative Care

Portal sites are closed with nonabsorbable sutures, and absorptive dressings are applied. Range of motion and weight-bearing restrictions are usually dictated by concomitant procedures, such as rotator cuff or labral repair. For isolated biceps tenodesis, a standard sling is provided for up to 6 weeks and may be removed for exercises. Pendulum hangs and gentle passive range of motion exercises of the shoulder and elbow are permitted. Resistive bending of the elbow or rotational movements of the forearm and wrist should be avoided to protect the biceps tenodesis. Physical therapy begins 1-2 weeks after surgery. Total rehabilitation time can take up to 3 months.

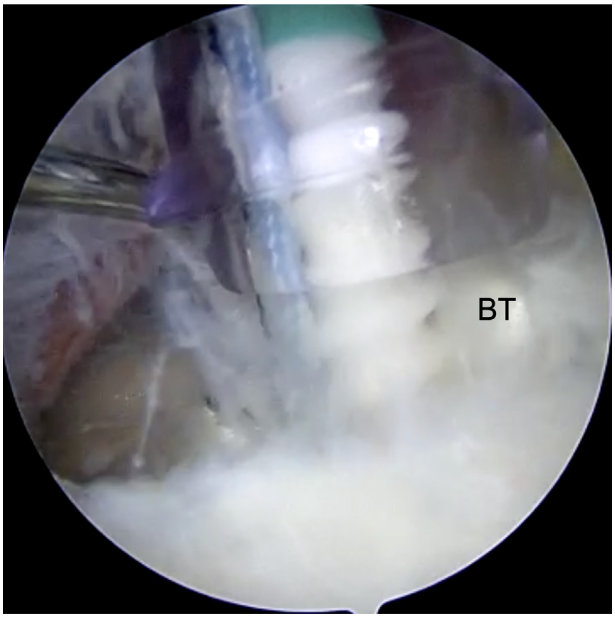

Fig 8. The two loop-and-tack sutures are secured with a 4.75-mm biocomposite knotless suture anchor in the proximal bicipital groove in situ. Subacromial view from the posterior portal in a left shoulder in lateral decubitus position. BT, long head biceps tendon.

Discussion

This article describes a simple arthroscopic technique using two loop-and-tack sutures and a knotless suture anchor to tenodese the LHBT in the proximal bicipital groove in situ. The major advantages include efficient localization of the LHBT and bicipital groove in the subacromial space, in situ tenodesis before tenotomy to maintain the length-tension relationship, double suture fixation for increased security, no arthroscopic knot tying, and decompression of the bicipital groove to potentially address more distal inflammatory pain without converting to an open approach (Table 1).[10,11] Although studies have shown that postoperative pain does not vary by location of tenodesis, the most important limitation remains that it may not address more distal pathology; however, if this is suspected, then subpectoral tenodesis techniques may be performed instead (Table 1).[12–15]

A biomechanical cadaveric study demonstrated statistically similar ultimate load to failure between onlay

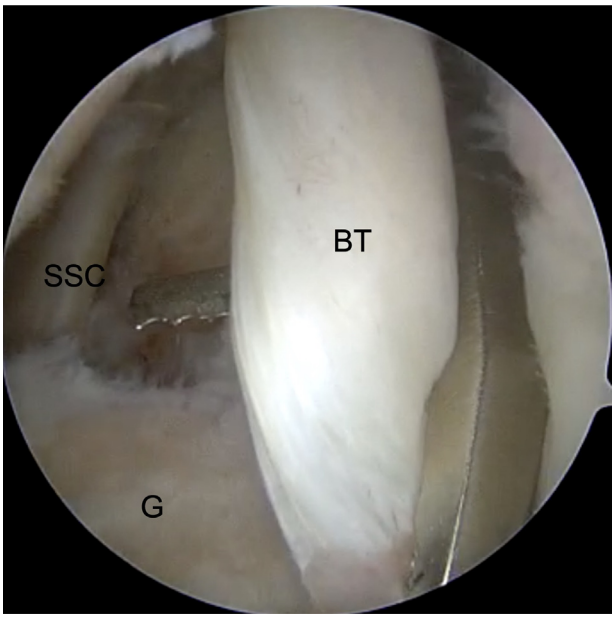

Fig 10. The glenohumeral joint is revisited. Tenotomy of the long head biceps tendon is performed at the superior labrum using arthroscopic scissors, and excess tendon is debrided intra-articularly. Glenohumeral view from the posterior portal in a left shoulder in lateral decubitus position. BT, long head biceps tendon; G, glenoid; SSC, subscapularis.

suture anchor and inlay interference screw techniques at the superior aspect of the bicipital groove. The mechanism of failure for both techniques were pullout of the suture or tendon past the implant.[16] A randomized controlled trial comparing anatomical and functional outcomes between suture anchor and interference screw techniques found an increased risk of anatomical failure with interference screws. The authors postulated that the screw may be cutting into the tendon during insertion.[17] A loop-and-tack technique similar in construct to the one described in this article has been previously published and reported to have excellent outcomes. The notable differences in that technique are that tenotomy is performed before tenodesis, so the native location of the LHBT can only be approximated, the tenodesis site is intra-articular and proximal to the biceps sling, a single loop-and-tack suture is used, and the transverse humeral ligament is not released.[18]

This technique provides an in situ variation of arthroscopic suprapectoral biceps tenodesis for inclusion in the surgical armamentarium. It addresses the main goals of maintaining physiological tension of the LHBT, achieving secure fixation, and removing or decompressing pathologic tissue. Technical modifications, such as localization of the LHBT and bicipital groove in the subacromial space using sutures passed intraarticularly, handling of the LHBT using cinched loop sutures, and implementation of the double loop-and-tack construct using an antegrade suture passer make the execution of this technique more efficient (Table 2). Overall, this technique is easy to learn, does not add substantial surgical time, and can be combined with other necessary procedures without requiring additional incisions.

Table 1. Advantages and Limitations

Advantages
• Simple method to efficiently locate the LHBT and bicipital groove in the subacromial space
• In situ tenodesis before tenotomy to maintain physiological length-tension relationship of the biceps
• Two loop-and-tack sutures for increased security of fixation
• No arthroscopic knot tying
• Release of the transverse humeral ligament to address more distal inflammatory pain
• Option to revise to open subpectoral tenodesis if needed
Limitations
• May not address pathologies along the full length of and distal to the bicipital groove
• Tendinopathy distal to the bicipital groove may reduce LHBT strength and risk future rupture
• Must not injure the LHBT during unroofing of the bicipital groove and transverse humeral ligament release

Table 2. Pearls and Pitfalls

Pearls
• The antegrade suture passer is used in an unconventional manner to place the luggage tag type sutures. This can be performed efficiently and effectively. An alternative is to use a penetrating grasper to unload suture on one side and retrieve on the other side of the LHBT for the loop followed by penetrating the tendon for the tack stitch.
• The suture anchor can be placed through the anterior or anterolateral portal based on optimal perpendicular trajectory to the bicipital groove.
Pitfalls
• Hold tension on the Prolene sutures to reduce the risk of inadvertently cutting them with the shaver during subacromial bursectomy. An alternative is to use spinal needles to mark the LHBT intra-articularly and leave them in place during subacromial bursectomy.
• Soft tissue swelling in the subacromial space may occlude visualization. This technique is recommended to be performed after acromioplasty if indicated but before rotator cuff repair in the subacromial space.

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