

All-Arthroscopic Long Head of the Biceps Transfer: An Optional Technique for Soft-Tissue Biceps Tenodesis



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Abstract: Proximal tendinopathy of the long head of the biceps (LHB) is a common shoulder problem that requires surgical intervention, especially in patients with concomitant rotator cuff tears. The comparative results of biceps tenotomy and biceps tenodesis are still doubtful; both techniques show good to excellent results in terms of postoperative pain and functional outcomes. The described technique—all-arthroscopic LHB transfer—is an optional biceps tenodesis technique using all-arthroscopic soft-tissue tenodesis and arthroscopic suturing of the LHB to the short head of the biceps and coracoacromial ligament combined with release of the LHB from the bicipital groove.

Proximal tendinopathy of the long head of the biceps (LHB) is a common shoulder problem that requires surgical intervention, especially in patients with concomitant rotator cuff tears. This problem is a common finding during arthroscopic rotator cuff surgery. A wide range of LHB pathologies exist, including inflammation, partial tear, complete tear, degeneration, and subluxation, that can be the cause of shoulder pain. If the biceps tendon is subluxated from the groove or has a tear involving more than 30%, surgical procedures including biceps tenotomy or tenodesis are considered.¹ The general indication for tenotomy is LHB tendinopathy in patients with low functional demand, especially those older than 65 to 70 years, who were willing to accept the Popeye deformity. The indication for LHB tenodesis is active younger patients with cosmetic concerns. Either tenotomy or tenodesis can be performed by an open or arthroscopic

procedure. The LHB tenodesis can be performed with bony fixation to the proximal humerus or with soft-tissue tenodesis including the rotator interval, rotator cuff augmentation, or pectoralis major. To date, no differences have been shown in terms of clinical outcomes or functional scores with either technique.

Our technique is an arthroscopic soft-tissue LHB tenodesis. The all-arthroscopic LHB transfer (ABT) is an LHB tenodesis that comprises arthroscopic suturing of the LHB to the short head of the biceps and coracoacromial ligament (CAL) combined with release of the LHB from the bicipital groove (Table 1, Video 1).

Surgical Technique

Patient Position and Portals

The patient is placed in the beach-chair position, about 70° upright. A standard posterior viewing portal is created to visualize and examine the glenohumeral joint using a 30° arthroscope. An anterosuperior working portal is created with the outside-in technique through the rotator interval. The pathologic LHB is identified and cut from the LHB root while the superior glenoid labrum is preserved. Intra-articular procedures are performed depending on concomitant intra-articular pathologies, such as SLAP repair or subscapularis repair.

After the intra-articular work is completed, the 30° arthroscope is reinserted from the same skin incision of the posterior viewing portal through the subacromial space. Subacromial bursectomy with or without acromioplasty is performed from a lateral working portal. If

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The authors report that they have no conflicts of interest in the authorship and publication of this article. Full ICMJE author disclosure forms are available for this article online, as [supplementary material](#).

Received October 30, 2019; accepted January 9, 2020.

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2212-6287/191321

<https://doi.org/10.1016/j.eats.2020.01.015>

Table 1. Key Points

Tendinopathy of the proximal LHB is a common cause of shoulder pain and often occurs concomitantly with rotator cuff pathology. No ideal technique for surgery exists. Either tenotomy, bony tenodesis, or soft-tissue tenodesis has shown good to excellent postoperative results.

The described technique (ABT) is arthroscopic soft-tissue biceps tenodesis with suturing of the LHB to the short head of the biceps and coracoacromial ligament combined with release of the LHB from the bicipital groove.

ABT, all-arthroscopic long head of biceps transfer; LHB, long head of biceps.

the patient has a rotator cuff lesion or acromioclavicular joint (ACJ) osteoarthritis, rotator cuff surgery and/or ACJ resection is performed during this step using anterosuperior and lateral working portals. After the rotator cuff and/or ACJ procedure is completed, the arthroscope is inserted through the previous lateral portal; an anteroinferior working portal is then created (Fig 1).

Surgical Technique of ABT

The LHB is identified and removed from the LHB groove. The transverse humeral ligament is released. The LHB is pulled through skin via the anteroinferior working portal; then, the articular part—about 1.5 cm—is resected. The remaining proximal end of the LHB is sutured with No. 2 nonabsorbable suture (Hi-Fi; ConMed), around 1 to 1.5 cm in length, using a running whipstitch technique. Another No. 2 nonabsorbable suture is used to wrap around the LHB for later side-to-side tenodesis, about 1 cm distal to the first whipstitch suture (Fig 2).



Fig 1. Arthroscopic portals in a left shoulder, with the patient in the beach-chair position, about 70° upright. The posterior portal is used as the starting viewing portal. During tenodesis, we use a lateral viewing portal and anterosuperior and anteroinferior working portals.

In the next step, the coracoid, short head of the biceps (SHB), and CAL are identified; the surgeon usually needs to release the coracohumeral ligament and to perform anterior subdeltoid bursectomy. The SHB and CAL are sutured to the transferred LHB by both limbs of whipstitch sutures using a shuttle-relay method (Fig 3). The arm position is set in full elbow extension and 90° of forearm supination during knot tying. The previous side-to-side stitch of the LHB is sutured to the SHB and the knot is tied for additional side-to-side tenodesis (Fig 4). The final tenodesis is shown in Figure 5.

Rehabilitation Program

Shoulder range of motion and rehabilitation depend on the associated labral or rotator cuff procedures. After the ABT procedure, the patient undergoes arm sling immobilization for 1 month. Active elbow flexion-extension and pronation-supination are allowed with the weight of forearm, but the patient needs to avoid lifting more than 1 kg for the first month



Fig 2. In a left shoulder, the long head of the biceps is pulled through the anteroinferior working portal, and an intra-articular portion of about 1.5 cm is resected. The No. 2 nonabsorbable suture is used as the running whipstitch suture, around 1 to 1.5 cm in length (white suture). Another No. 2 nonabsorbable suture is used to wrap around the long head of the biceps for later side-to-side tenodesis, about 1 cm distal to the first whipstitch suture (blue suture).

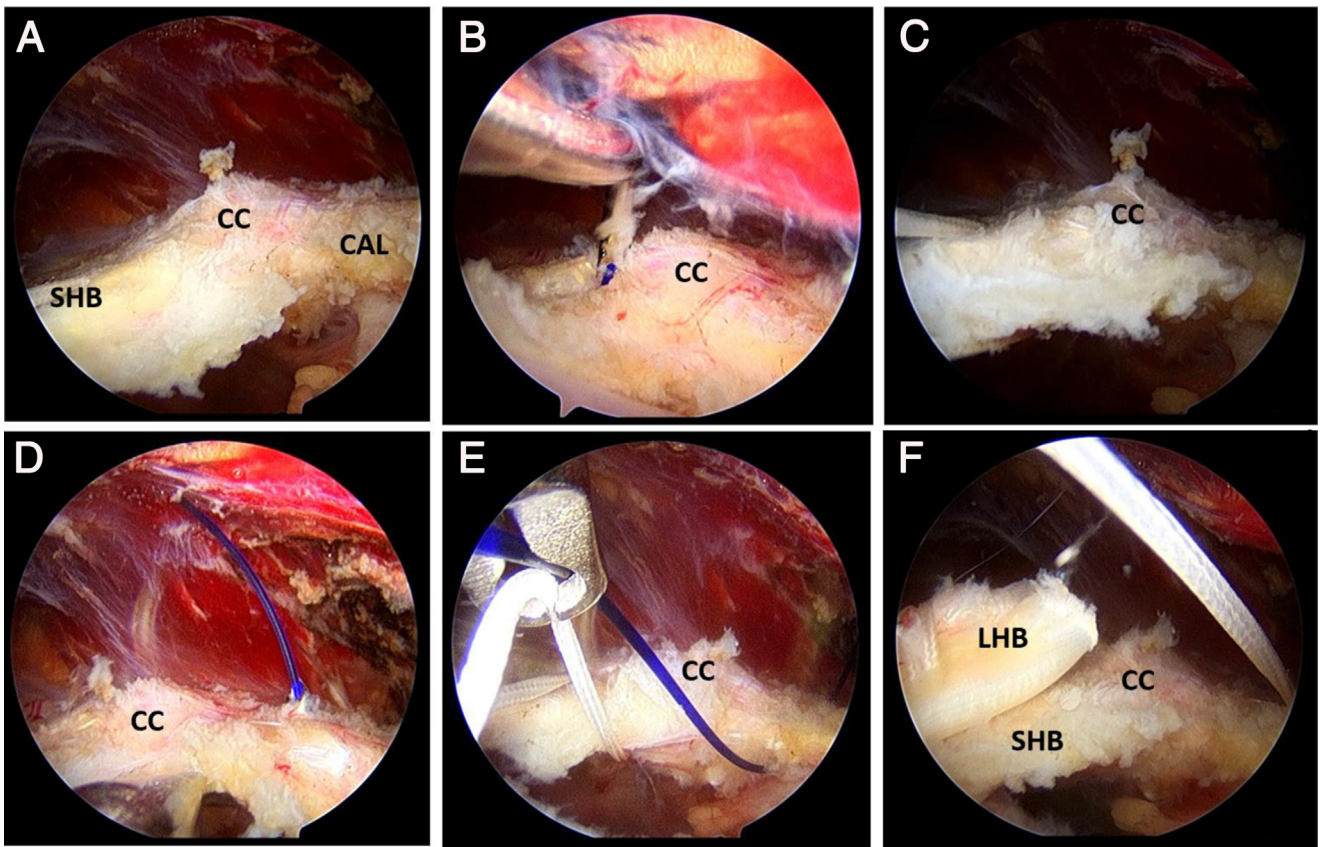


Fig 3. Arthroscopic view from the lateral portal in a left shoulder, with the patient in the beach-chair position and the shoulder positioned in about 60° of forward elevation and neutral rotation. (A) The important landmarks are identified. (B) The short head of the biceps (SHB) is sutured with a shuttle-relay technique. (C) First whipstitch limb suture of long head of biceps (LHB) to SHB. (D, E) The coracoacromial ligament (CAL) is sutured with a shuttle-relay technique. (F) Suturing of the first whipstitch limb of the LHB to the SHB and CAL is performed. (CC, coracoid process.)

postoperatively. The patient can use the elbow as normal daily activities within 4 to 6 weeks; strengthening exercises of the elbow can be promoted after 6 weeks postoperatively.

Discussion

Biceps tenodesis has become popularized and has shown excellent postoperative results in either active or elderly patients. The indications for LHB tenodesis are

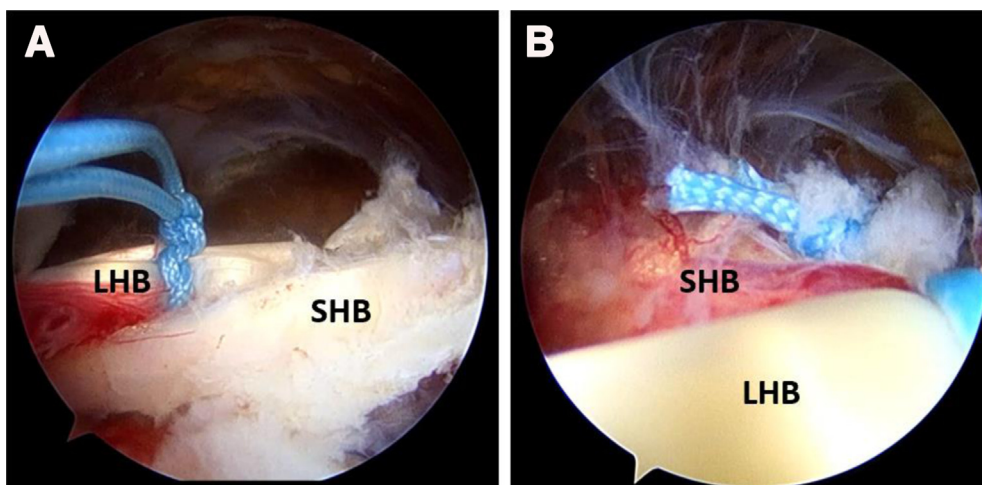


Fig 4. Arthroscopic view from the lateral portal in a left shoulder, with the patient in the beach-chair position and the shoulder positioned in about 60° of forward elevation and neutral rotation. (A) The side-to-side suture (blue sutures) is identified after the whipstitch knots are tied. (B) After side-to-side suturing of long head of biceps (LHB) to short head of biceps (SHB) and knot tying.

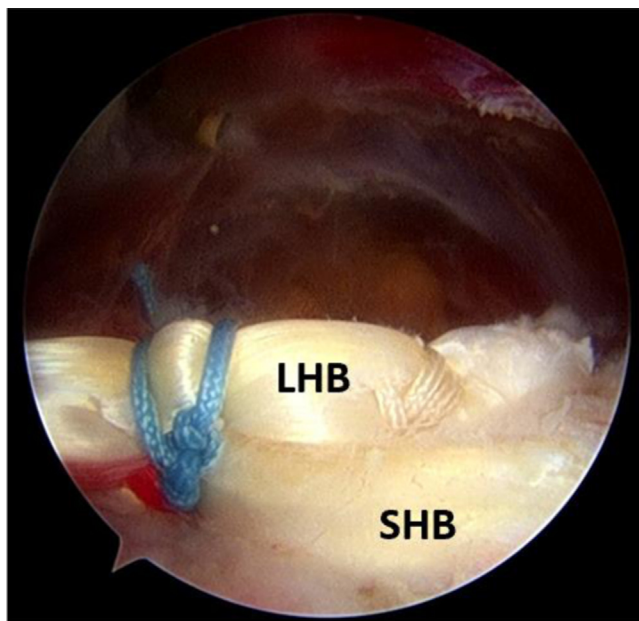


Fig 5. Arthroscopic view from the lateral portal in a left shoulder, with the patient in the beach-chair position and the shoulder positioned in about 60° of forward elevation and neutral rotation. The final all-arthroscopic LHB transfer is shown; the white suture is the whipstitch suture to the short head of the biceps (SHB) and coracoacromial ligament (CAL), and the blue suture is the side-to-side suture to the SHB. (LHB, long head of biceps.)

still inconsistently reported.² Common indications for tenodesis are an LHB tear, unstable LHB, LHB tenosynovitis, and unstable SLAP tear.

Many studies have shown no significant difference between biceps tenotomy and tenodesis. The Popeye deformity occurs more in tenotomy patients, without significant functional outcomes. A prospective, single-blinded, randomized controlled trial evaluated pain relief and subjective outcomes between 20 patients undergoing biceps tenotomy and 14 patients undergoing arthroscopic bony tenodesis with interference screws, with a mean age of 56 years (range, 30-77 years).³ The results showed lower of mean visual analog scale pain scores at 3 months in the tenotomy group; at 2-year follow-up, no differences were found in visual analog scale, American Shoulder and Elbow Surgeons, or Single Assessment Numeric Evaluation scores. The Popeye deformity was found in 5 of 20 tenotomy patients (25%) and 1 of 14 tenodesis patients (7%). A meta-analysis showed no difference in postoperative outcomes between tenodesis and tenotomy except that the Popeye deformity and cramping pain were more frequently observed in tenotomy patients.⁴ A systematic review of a total of 205 arthroscopic tenodesis and 271 open tenodesis procedures showed that both open and arthroscopic tenodesis yielded good or excellent outcomes in 98% of cases and poor

Table 2. Pearls and Pitfalls

Over-tensioning of the tenodesis may cause postoperative pain and unsatisfactory results.
Soft-tissue LHB tenodesis using sutures could prevent the hardware complications from screws or anchors.
Meticulous hemostasis and bleeding control during work in the subacromial and subdeltoid spaces are crucial steps to achieve good visualization and prevent intraoperative complications.
LHB, long head of biceps.

outcomes in only 2%.⁵ The biceps tenodesis is still the preferable option over tenotomy in patients older than 55 years who have cosmetic concerns about the Popeye deformity.⁶

LHB transfer to the conjoint tendon (arthroscopic subdeltoid LHB tendon transfer) was developed in 2005⁷; studies of short-term⁸ and mid-term⁹ results were also published, with an average postoperative period of 6.4 years. The results showed a good to excellent rating in 87.4% of cases according to the American Shoulder and Elbow Surgeons score. The rate of the Popeye deformity was about 5% in this mid-term follow-up study. The previously described technique comprises direct transfer of the LHB to the conjoint tendon with 3 or 4 side-to-side stitches of the LHB to the conjoint tendon.

An anatomic study showed that the length of the articular portion of the LHB is about 37.2 ± 6.4 (mean \pm standard deviation) in male cadaveric shoulders and 30.0 ± 4.4 in female cadaveric shoulders.¹⁰ Another study found that the mean length of the intra-articular segment of the LHB was 2.53 cm (range, 1.72-3.55 cm).¹¹ Our technique differed from previous techniques in that the articular portion—about 1.5 cm—was removed because many pathologies such as an LHB tear, hourglass LHB (hypertrophy), or inflammation often involved this portion. To avoid over-tightening of the tenodesis that may cause postoperative pain, we did not remove the whole length of the articular portion. Moreover, in this technique, the LHB was sutured to the SHB and CAL to prevent cut-through along the longitudinal fibers of the conjoint tendon with only side-to-side sutures. The pearls and pitfalls of ABT tenodesis are shown in Table 2. To avoid musculocutaneous nerve injury, sutures should be placed less than 1 cm from the lateral aspect of the conjoint tendon. The LHB should undergo tenodesis to the anterior aspect of the conjoint tendon to prevent subcoracoid impingement or subscapularis adhesion.

The advantages of our technique include the following: The suture materials used for tenodesis can be reused from sutures remaining after rotator cuff repair by either a single- or double-row technique; no bony tunnel is required, which may prevent fracture complications from bony tenodesis; and the transverse humeral ligament is also released to decrease

Table 3. Advantages, Risks, and Limitations**Advantages**

- Direct visualization helps to adjust the tension of the tenodesis, and the tenodesis site can be secured by adding side-to-side sutures.
- The suture materials used for tenodesis can be reused from sutures remaining after rotator cuff repair by either a single- or double-row technique.
- No bony tunnel is required, which may prevent fracture complications from bony tenodesis.
- The transverse humeral ligament is released to decrease postoperative pain around the LHB groove.

Risks and limitations

- A learning curve and meticulous hemostasis are needed.
- The proper tension of the LHB tenodesis with this technique still needs further study.
- Suture at the medial aspect of the conjoint tendon should be avoided to prevent musculocutaneous nerve injury. Our recommendation is suture placement <1 cm from the lateral aspect of the conjoint tendon.
- The LHB should undergo tenodesis to the anterior aspect of the conjoint tendon to prevent subcoracoid impingement or subscapularis adhesion.

LHB, long head of biceps.

postoperative pain around the LHB groove. However, the limitations include the required learning curve and need for meticulous hemostasis. In addition, the proper tension of the LHB tenodesis with this technique still needs further study (Table 3).

Conclusions

The ABT is an optional technique for soft-tissue biceps tenodesis. This technique comprises arthroscopic suturing of the LHB to the SHB and CAL combined with release of the LHB from the bicipital groove. Further studies are needed to compare the outcomes of this technique with those of other tenodesis and tenotomy techniques.

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