



The Arthroscopic Loop Tenodesis Procedure: An Implant-Free Technique to Treat Long Biceps Tendon Pathologies

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Abstract: Different surgical techniques are available to treat pathologies of the long biceps tendon. Although simple tenotomy of the tendon can result in distalization of the biceps muscle, implant-associated complications can occur after bony tendon fixation within a biceps tenodesis. This article describes the arthroscopic loop tenodesis procedure. The technique is based on an enlargement of the proximal tenotomized tendon by creating a tendon loop, which subsequently blocks itself at the entrance to the bicipital groove and prevents distalization of the biceps muscle. This procedure can be performed arthroscopically, resulting in a stable fixed tendon without an anchor or other foreign materials, and might be suitable for young and old patients with biceps tendon pathologies.

Lesions of the long head of biceps (LHB) often lead to anterior shoulder pain. Many different arthroscopic and open techniques have been described to address these pathologies.¹ Although simple tenotomy is a minimally invasive and easily performable arthroscopic technique, a tenodesis is recommended to prevent distalization of the biceps muscle.^{2,3} In particular, bony fixation tenodesis techniques, using an anchor or interference screw, show good results, especially in cosmetic concerns⁴; nevertheless, several implant-associated complications can occur. Besides fractures and infection, residual pain at the site of tenodesis are observed.⁵⁻⁷

The purpose of this article is to present the so-called loop tenodesis procedure for treatment of patients

with long biceps tendon pathologies. An enlarging of the tenotomized proximal LHB diameter, by creating a tendon Loop, supports the self-locking mechanism with a subsequent stable “autotenodesis” at the entrance to the bicipital groove (Video 1). The loop tenodesis procedure combines the advantages of both simple tenotomy and anchor tenodesis by inventing a fast and minimally invasive procedure that results in a stable fixed tendon without an implant.

Surgical Technique

Preoperative Planning

Next to full functional assessment and clinical examination, magnetic resonance imaging is required to determine the type of LHB lesion and concomitant pathologies. Dynamic ultrasound examination is conducted to evaluate instabilities of the LHB.

Patient Positioning

All procedures are performed under general anesthesia and perioperative antibiotics. The patient is placed in the beach chair position. The affected arm is fixed in a supporting device. The bony landmarks are identified and marked.

Portal Placement and Diagnostic Arthroscopy

The arthroscopic procedure requires 3 portals: a standard posterior viewing portal for diagnostic arthroscopy and bursoscopy, an anteroinferior working portal, and an anterolateral portal. Diagnostic arthroscopy through

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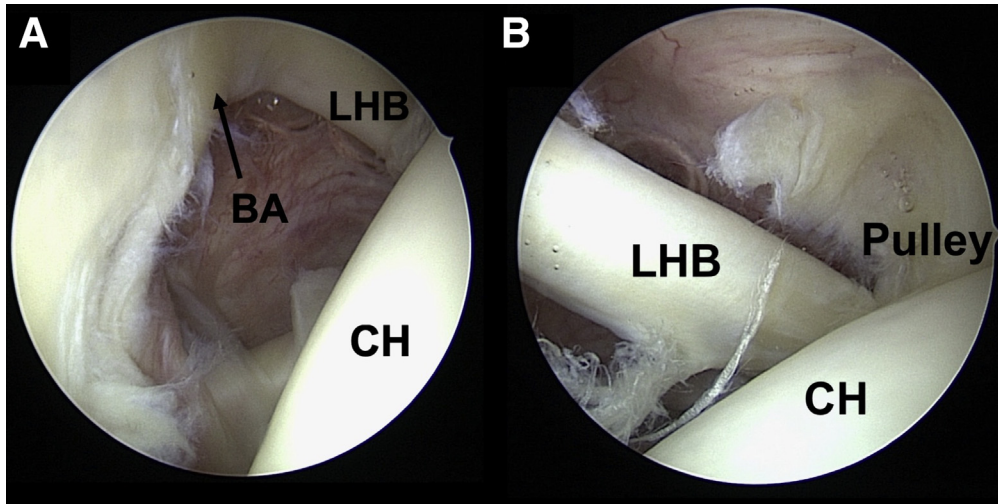


Fig 1. Right long biceps tendon from the posterior portal with the patient placed in beach chair position. (A) Biceps anchor and the intra-articular biceps tendon. (B) Biceps pulley with pulley lesion. (BA, biceps anchor; CH, caput humeri; LHB, long head of biceps.)

the posterior portal is used to identify structural lesions of the long biceps complex and concomitant pathologies (Fig 1). After dynamic and palpatory examination of the intra-articular portion of the biceps tendon using a probe through the anteroinferior working portal, the stability of the pulley and the SLAP complex is evaluated. An anterolateral portal of 2 cm in length just above the bicipital groove is prepared.

Preparing the Bicipital Groove and Tenotomy of the LHB

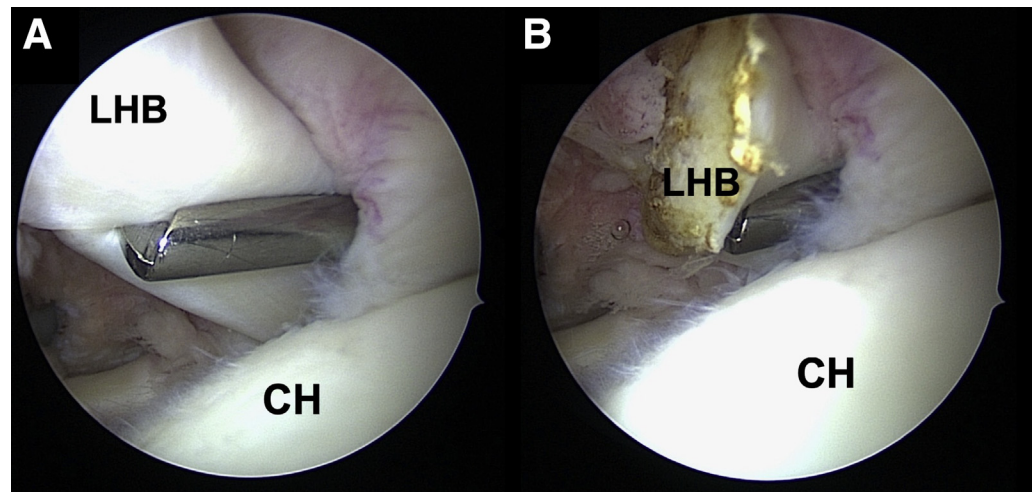
The proximal part of the bicipital groove is debrided using a burr to create a slightly bleeding surface to allow ingrowth of the tendon loop. A surgical clamp is introduced through the anterolateral portal and the LHB is securely grabbed. After tenotomy of the LHB close to its base, using an electrothermal instrument, the tendon is

pulled extracorporeally (Fig 2). Subsequently, about 0.5 cm of the proximal tenotomized tendon is resected.

Performing the Loop and Tendon Release

After tenotomy of the LHB, the naming loop is created extracorporeally by folding and doubling the proximal 1.5 cm of the tendon to enlarge the proximal diameter of the LHB. The loop is fixed with a suture (No. 1 Vicryl; Ethicon, Somerville, NJ) (Fig 3). After completion of the loop, the tendon is released and pushed intraarticularly. The tendon loop blocks itself stable at the entrance of the bicipital groove; therefore, slipping out of the sulcus bicipitalis is prevented (Fig 4). According to the presence of additional pathologies, any concomitant procedures are performed after finalization of the loop tenodesis procedure.

Fig 2. Right long biceps tendon from the posterior portal with the patient placed in beach chair position (caput humeri). (A) The long biceps tendon is securely grabbed with a surgical clamp through the anterolateral portal. (B) Tenotomy of the biceps tendon close to its base; the biceps tendon is pulled extracorporeally through the anterolateral portal. (CH, caput humeri; LHB, long head of biceps.)



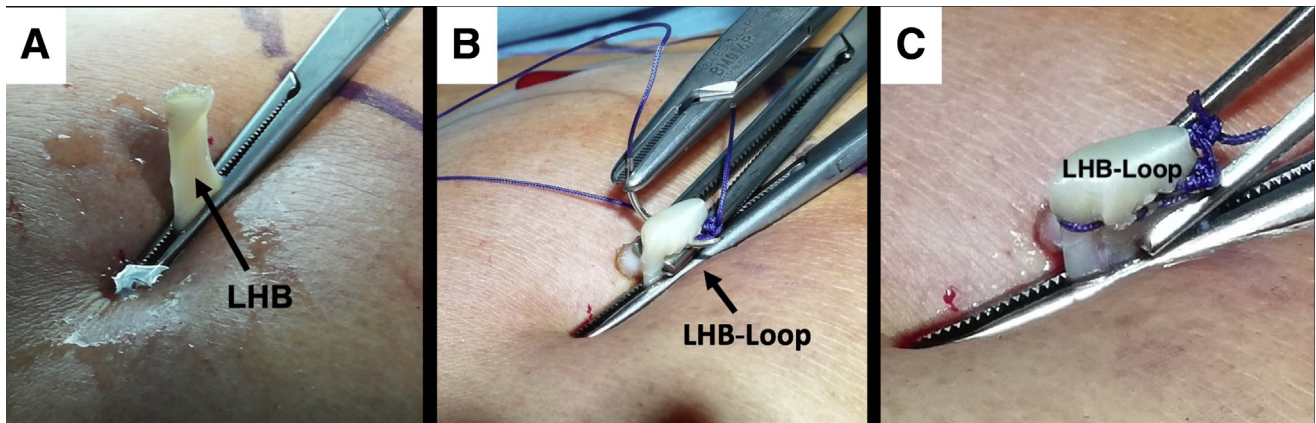


Fig 3. Anterolateral portal of a right shoulder with the tenotomized long biceps tendon pulled extracorporeally. (A) Long biceps tendon after resection of the proximal 0.5 cm. (B) Creating the long biceps tendon loop by folding the tendon and fixing the loop with a suture. (C) Finalized long biceps tendon loop. (LHB, long head of biceps; LHB-loop, long biceps tendon loop.)

Postoperative Rehabilitation and Treatment

The postoperative rehabilitation protocol follows recommendations for arthroscopic tenodesis procedures. All patients receive a supervised physical therapy program. The protocol includes a sling for 4 weeks that protects the LHB with the elbow flexed 90° and in a neutral rotation position. Passive range of motion is initiated from day 2 after surgery until 6 weeks. The patients are informed to avoid any elbow flexion and supination maneuvers against resistance for 6 weeks. In addition, an upper arm bandage has to be worn for 6 weeks after the surgery. Depending on the presence of additional performed procedures, alterations of the postoperative rehabilitation protocol can be required.

Discussion

Current surgical treatment strategies to address pathologies of the LHB are simple tenotomy and tenodesis. Many authors recommend a strong bony fixation of the LHB compared with a simple tenotomy to reduce complications resulting from a distalization of the LHB such as muscle cramps, cosmetic deformities, or reduction of elbow flexion and supination strength.^{2,3,8} A complete slippage of the tenotomized tendon with a subsequent distalization of the biceps muscle occurs in very few patients only.⁸ This self-locking potential of the tendon in the bicipital groove is described as “autotenodesis” of the LHB.⁹ One possible explanation for this phenomenon is “vinculae,” which cross-connect the long biceps tendon and the bicipital groove.¹⁰ Another explanatory model is based on the biceps tendon anatomy. The intraarticular portion of the LHB has a larger diameter compared with the tendon at the bicipital groove and the diameter of the biceps sulcus itself. In some patients, therefore, a trapping of the “larger” proximal tendon in the bicipital groove occurs after tenotomy.¹¹ The arthroscopic loop tenodesis procedure has the potential to combine the advantages of both simple tenotomy and

tenodesis. It represents an arthroscopic procedure that can be performed quickly because of its similarity to a simple tenotomy, resulting in a stable fixed tendon without an anchor or other foreign materials. In case of high-grade pulley lesions, a limited primary stability of the LHB-loop with a subsequent distalization of the biceps muscle could be a limitation of this technique. This distalization of the tendon can lead to muscle cramps, cosmetic deformities, or reduction of elbow flexion and supination strength. Anterior shoulder pain caused by the tendon loop could also be conceivable. [Table 1](#) summarizes the advantages and limitations of this technique.

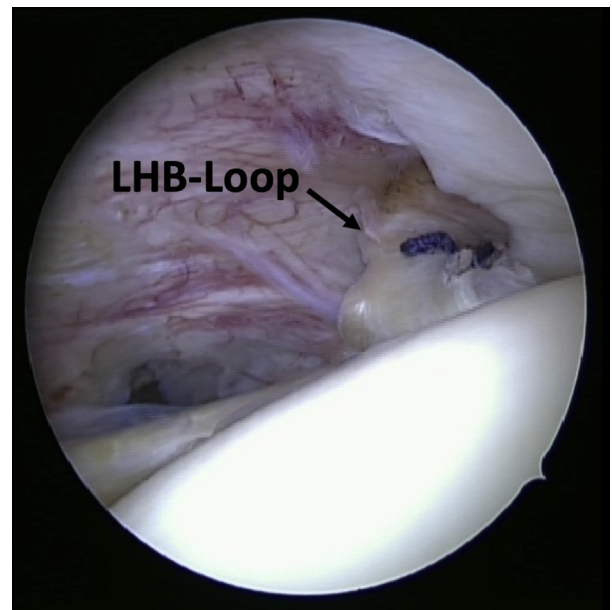


Fig 4. Right shoulder from the posterior portal with the patient placed in beach chair position. Visualization of the long biceps tendon loop blocked at the entrance of the bicipital groove. (LHB-loop, long biceps tendon loop.)

Table 1. Advantages and Limitations of the Loop Tenodesis Procedure

Advantages

- Relatively easy to perform
- Short duration of surgery
- Low risk of intraoperative complications
- No anchor or screw necessary
- Low risk of infection
- Stable fixed tendon

Limitations

- Limited primary stability in case of high-grade pulley lesion
- Lack of clinical data

Nevertheless, because of its properties, the loop tenodesis procedure can close the gap between simple tenotomy and tenodesis and might be suitable for young and old patients with biceps tendon pathologies.

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