Technical Note

Arthroscopic Superior Capsule Reconstruction Using Autologous Fascia Lata and Biceps Tendon Augmentation

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Abstract: Whereas arthroscopic superior capsule reconstruction has recently been introduced to treat irreparable rotator cuff tears with encouraging outcomes, graft options and fixation remain debated. The purpose of this article is to introduce a modified arthroscopic technique using the long head of the biceps tendon as augmentation for superior capsule reconstruction with fascia lata autograft.

Given tremendous advances in arthroscopic techniques, treatment of massive rotator cuff tears (RCTs) remains a challenge to shoulder surgeons. If the tear is irreparable or too extensive to achieve an optimal repair, the rotator cuff muscle becomes stiffer and shows atrophy with fatty infiltration. The absence of rotator cuff integrity and coordination leads to proximal migration of the humeral head with loss of the balanced force couple.[1] Superior capsule reconstruction (SCR) is a recently developed technique and has been introduced to treat irreparable RCTs by using tensor fascia lata (FL) autograft[2] or human dermal allograft.[3] Both grafts have achieved encouraging short-term outcomes. Despite encouraging outcomes in recent reports, debate still exists regarding graft options[4] and the drawbacks of over-tightening with side-to-side suture.[5] We describe an arthroscopic technique of long head of the biceps tendon (LHBT) augmentation in autologous FL SCR for irreparable RCTs.

Surgical Technique

Under general anesthesia, the patient is placed in the lateral decubitus position. A longitudinal skin incision is made over the lateral thigh on the same side as the lesioned shoulder. Tensor FL graft of about 4 × 15 cm in size is harvested under meticulous dissection and hemostasis. Then, the wound is approximated layer by layer with subcuticular suture. After proper dressing, the patient is changed to the beach-chair position. Standard arthroscopic portals are used including posterior, posterolateral, lateral, anterolateral, anterior, and Neviaser portals. A meticulous examination is undertaken to confirm the condition of the articular

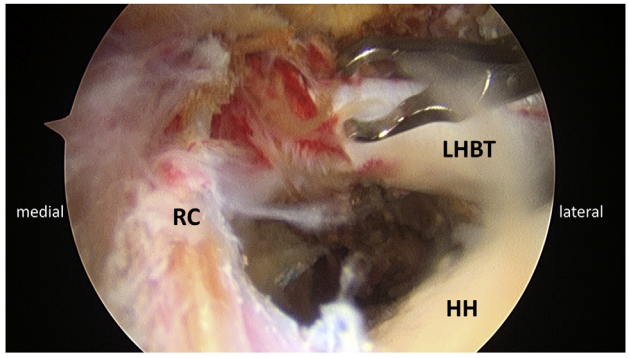

Fig 1. Arthroscopic view of right shoulder through posterior portal with patient in beach-chair position. The retracted rotator cuff (RC), long head of the biceps tendon (LHBT), and humeral head (HH) are identified.

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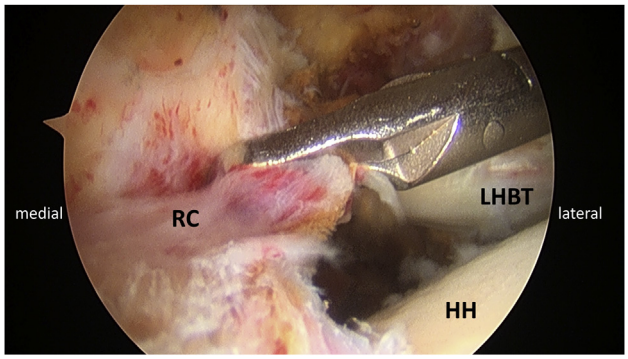

Fig 2. Arthroscopic view of right shoulder through posterior portal with patient in beach-chair position. Irreparability is confirmed by retracting the residual rotator cuff (RC) tissue. (HH, humeral head; LHBT, long head of biceps tendon).

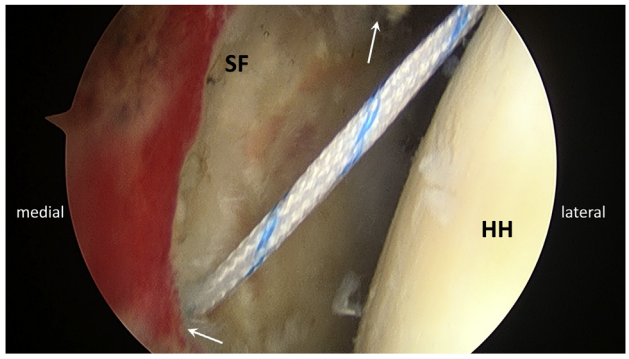

Fig 4. Arthroscopic view of right shoulder through posterior portal with patient in beach-chair position. Two suture anchors (arrows) are inserted at the anterior and posterior supraglenoid fossa (SF). (HH, humeral head.)

cartilage, massive RCT, and LHBT (Figs 1 and 2). In the case of an articular-sided or upper full-thickness subscapularis tear, approximation with a 2.3-mm Iconix all-suture anchor (Stryker Endoscopy, San Jose, CA) is performed at the tuberosity footprint. Then, the arthroscope is introduced into the subacromial space through the posterior portal. A motorized shaver and a radiofrequency device (Super TurboVac 90; ArthroCare, Sunnyvale, CA) are used to perform thorough bursectomy, release of tendon adhesion, and debridement of the tendon stump on the greater tuberosity and to smooth the subacromial surface through anterolateral and posterolateral working portals. Further preparation of the supraglenoid fossa and greater tuberosity to facilitate graft-bone healing is performed by a 4.0-mm motorized burr. The width of the supraglenoid fossa is measured (Fig 3) to facilitate accurate insertion of 2 suture anchors (Fig 4). An additional suture passage is prepared (Fig 5) for subsequent graft fixation to the superior labrum near the biceps anchor. Then, an extended skin incision of 2 cm is made along the lateral portal from the acromial margin downward. A 2-cm cannula is inserted through a deltoid muscle–splitting approach.

The FL graft is folded and securely sutured to become a 3×4–cm^2 patch with a thickness of about 6 to 8 mm. With the shoulder positioned in 30° of forward flexion and 30° of abduction and supported stably in an arm holder, the FL graft patch is then introduced through the anterolateral portal. Two 1.4-mm Iconix all-suture anchors are used to fix the anterior corner and posterior corner of the medial 3-cm side of the graft patch. Two 2.3-mm Iconix all-suture anchors are inserted just lateral to the margin of the articular cartilage to fix the lateral portion of the graft patch; the anterior anchor is beside the LHBT (Fig 6), and the posterior is beside the residual rotator cuff tendon (Fig 7). With full coverage of the rotator cuff defect to allow tensionless side-to-side suture (Fig 8), the lateral portion of the FL graft is further secured to the greater tuberosity by a

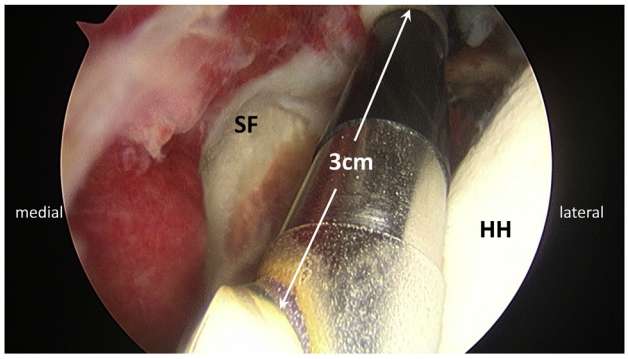

Fig 3. Arthroscopic view of right shoulder through posterior portal with patient in beach-chair position. The supraglenoid fossa (SF) is properly prepared, and the width is measured. (HH, humeral head.)

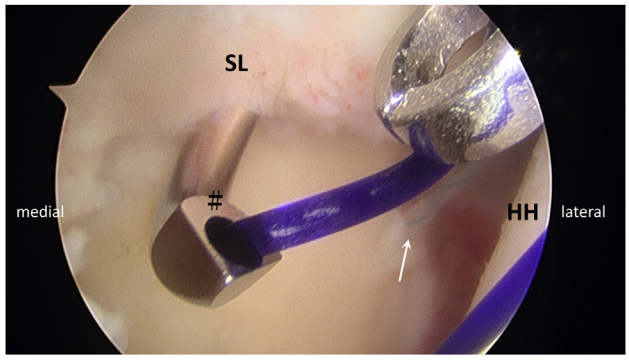

Fig 5. Arthroscopic view of right shoulder through posterior portal with patient in beach-chair position. A leading suture passage (pound sign) is prepared for subsequent graft fixation to the superior labrum (SL), in addition to suture anchor (arrow) fixation. (HH, humeral head.).

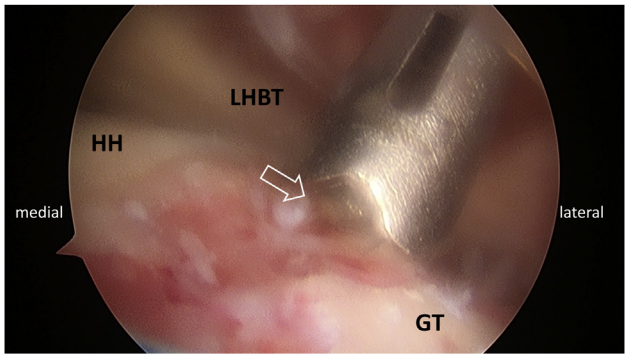

Fig 6. Arthroscopic view of right shoulder through posterior portal with patient in beach-chair position. Two double-loaded suture anchors are applied on the medial side of the greater tuberosity (GT), close to the border of the articular cartilage of the humeral head (HH); the anterior anchor (arrow) is inserted beside the long head of the biceps tendon (LHBT).

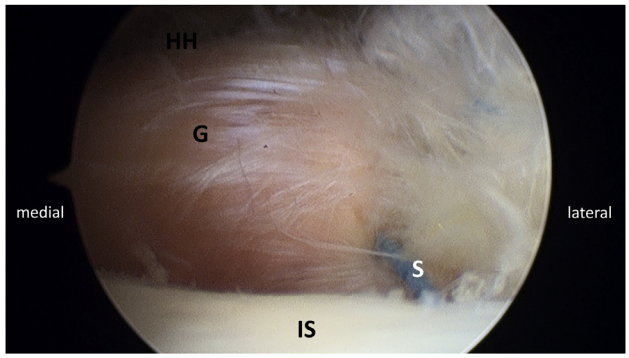

Fig 8. Arthroscopic view of right shoulder through posterior portal with patient in beach-chair position. Full coverage of the rotator cuff defect is achieved by fascia lata graft (G) with close approximation to the residual infraspinatus (IS) tendon to allow tensionless side-to-side suture (S).

compression suture-bridging technique (Fig 9) using two 4.5-mm Reelx anchors (Stryker Endoscopy) (Fig 10). Then, the proximal part of the LHBT is identified by probing (Fig 11) and is incorporated into the anterosuperior part of the fascia graft by Ethibond suture (Ethicon, Somerville, NJ) (Fig 12). Before closure of the space between the fascia graft and the residual infraspinatus posteriorly, the integrity of the graft patch and full coverage of the rotator cuff defect are meticulously confirmed with arthroscopic examination (Video 1). The wounds are then closed with No. 3-0 nylon suture. An abduction pillow brace is applied for arm immobilization in a position of 45° of abduction.

Postoperative Care

The operative arm is immobilized in a 45° abduction brace for 4 weeks. Then, the rehabilitation program starts with the Codman exercise and gentle assisted forward elevation. Active motion is prohibited until full passive elevation is reached; this begins at least 4 months after SCR surgery. For patients with inadequate internal rotation, passive stretching is started at least 6 months after surgery. Resistance exercise is allowed at 9 months postoperatively.

Discussion

Owing to disruption of the shoulder force couple, the absence of the rotator cuff and superior capsule may change the mechanics of the shoulder joint with subsequent upper migration of the glenohumeral articulation.[6,7] The technique of SCR was designed to provide a biological constraint to superior migration and thus to obtain a stable fulcrum of the humeral head.[8,9] In the technique described in this report, we incorporated the LHBT into the FL graft for SCR. The rationale is 3-fold: First, the LHBT is regionally available inside the

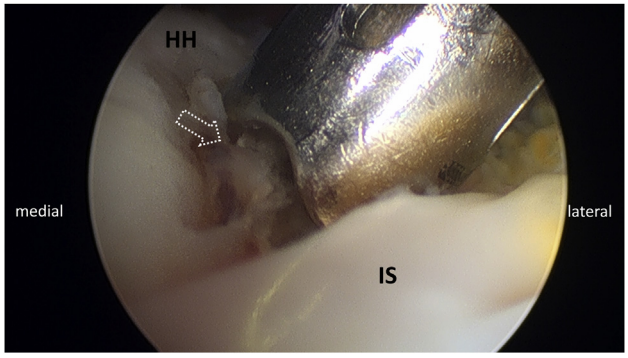

Fig 7. Arthroscopic view of right shoulder through posterior portal with patient in beach-chair position. The posterior anchor (arrow) at the medial greater tuberosity is inserted beside the residual infraspinatus tendon (IS). (HH, humeral head.)

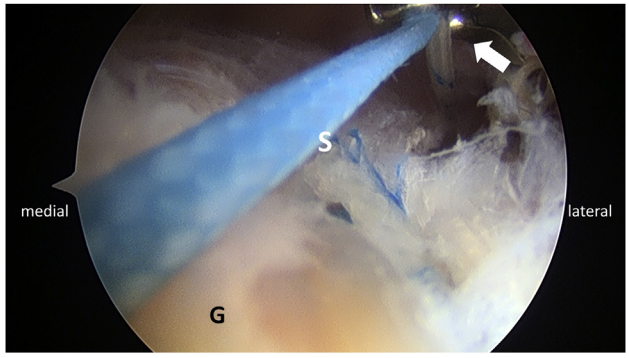

Fig 9. Arthroscopic view of right shoulder through posterior portal with patient in beach-chair position. The lateral part of the fascia lata graft (G) is secured to the greater tuberosity via a suture-bridging technique by shuffling (arrow) the anchor sutures (S) in the medial tuberosity laterally.

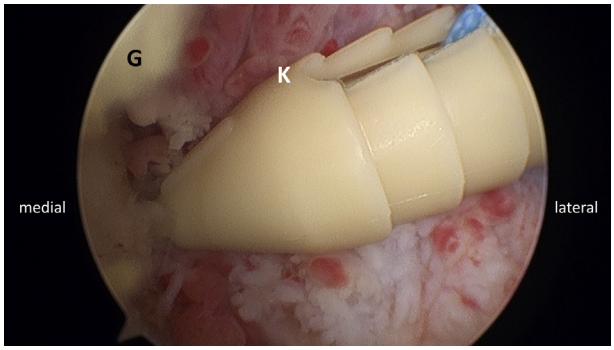

Fig 10. Arthroscopic view of right shoulder through posterior portal with patient in beach-chair position. Knotless anchors (K) are inserted for lateral-row fixation of the fascia lata graft (G).

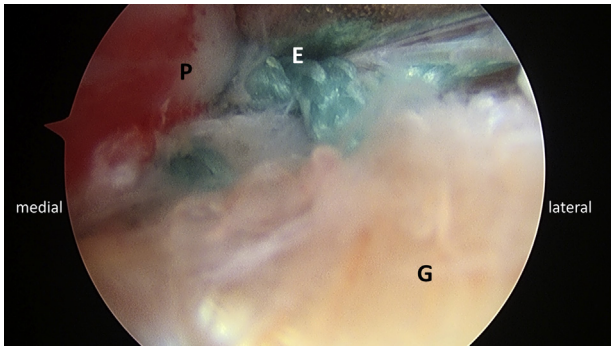

Fig 12. Arthroscopic view of right shoulder through posterior portal with patient in beach-chair position. The proximal part (P) of the long head of the biceps tendon is secured to the fascia lata graft (G) by Ethibond suture (E).

shoulder joint and has been successfully used as an augmentation for supporting biomechanical forces in rotator cuff repair.[5,10] Incorporation of the LHBT with the FL patch may provide additional thickness and a stabilizing effect against anterior translation. Second, the FL patch could be secured anterosuperiorly by suturing to the LHBT instead of the subscapularis tendon because anterior side-to-side suture may be unnecessary or even cause concerns of shoulder stiffness owing to closure of the rotator interval.[11] Third, the LHBT is rich in tenocytes that may imitate the physiological demands of the rotator cuff and is thus considered a suitable graft for augmentation in RCT repair and capsular reconstruction.[10,12] Being different from other techniques using a single transposed LHBT for SCR surgery, our method can be readily planned based on preoperative magnetic resonance imaging even with a partial tear of the LHBT. Limitations and disadvantages include possible pain generation from the LHBT and additional suture tangling with the LHBT-to-FL suture; moreover, passing the FL patch to the superior glenoid in the presence of the LHBT can be technically demanding. Surgical pearls and pitfalls are listed in Table 1. Although incorporation of the LHBT with the FL patch may create more suture tangling, this technique does not require additional suture anchor fixation and thus avoids the possible complications that occur with suture anchors and poor bone quality. Advantages and disadvantages of the index surgical procedure are listed in Table 2.

In conclusion, with the advantages of augmenting anterosuperior glenohumeral stability while skipping anterior side-to-side suture to avoid potential stiffness, we believe the proposed technique incorporating the LHBT with the FL autograft for SCR can be a useful option in treating irreparable massive RCTs.

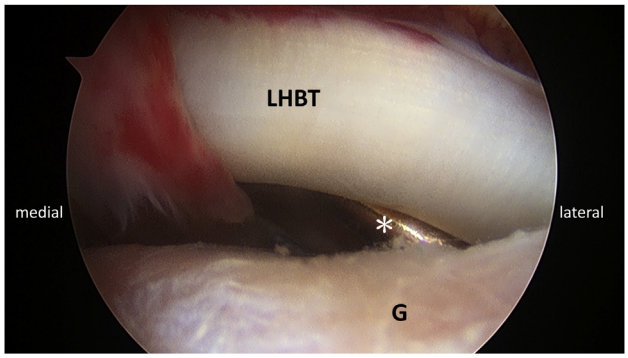

Fig 11. Arthroscopic view of right shoulder through posterior portal with patient in beach-chair position. The long head of the biceps tendon (LHBT) is identified above the fascia lata graft (G) by probing (asterisk).

Table 1. Surgical Pearls and Pitfalls

Pearls
An arm holder should be used with the shoulder positioned in 30° of forward flexion and 30° of abduction for SCR.
The optimal size of the FL graft patch is 3 cm wide, 5-6 mm long, and 6-8 mm thick.
An extended skin incision is made for introduction of the FL graft patch through the lateral arthroscopic portal.
Downward arm traction is applied to facilitate passage of the FL graft patch.
Ethibond suture is applied passing superior labrum to incorporate the proximal LHBT with the FL graft.
Pitfalls
Suture tangling should be avoided by keeping the sutures of all 4 anchors separate during graft passage.
Anterior over-tightness can be remitted by skipping graft-to-subscapularis suture.
Posterior over-tightness can be avoided by providing sufficient graft-infraspinatus contact for side-to-side suture.
Widely separated insertion of 2 knotless anchors is performed for suture-bridge fixation of the lateral portion of the FL graft patch.
The surgeon should mind the bone quality for anchor insertion in the lateral wall of the greater tuberosity.

FL, fascia lata; LHBT, long head of biceps tendon; SCR, superior capsule reconstruction.

Table 2. Advantages and Disadvantages of SCR Using FL and LHBT Augmentation

Advantages
The LHBT is a locally available autograft.
The FL patch can be secured anterosuperiorly by suturing to the LHBT.
The technique provides additional thickness and a stabilizing effect against anterior translation of the humeral head.
The preserved vascular supply of the transposed LHBT may improve the progression of graft healing after SCR.
The technique can be applied even with partial tears of the LHBT and thus can be readily planned before surgery.
No additional suture anchor fixation is needed for the LHBT.
Anterior side-to-side suture and possible over-tightness can be remitted.
Disadvantages
Pain generation from the LHBT is possible.
Additional suture tangling can occur from the LHBT-to-FL suture.
Passing the FL graft to the superior glenoid in the presence of the LHBT is more technically demanding.
The technique is not applicable for larger subscapularis tears.

FL, fascia lata; LHBT, long head of biceps tendon; SCR, superior capsule reconstruction.

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