



# Arthroscopic-Assisted Lower Trapezius Tendon Transfer With Fascia Lata Autograft for Irreparable Posterior–Superior Rotator Cuff Tears

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**Abstract:** Lower trapezius tendon transfer is a surgical procedure that has become increasingly popular in recent years. The biggest advantage of this method is that the pulling direction of the lower trapezius is the same as that of the infraspinatus. Thus, the transferred lower trapezius tendon can biomechanically mimic the functions of the posterior–superior rotator cuff. In this technical presentation, we described the surgical technique of an arthroscopic-assisted lower trapezius tendon transfer, which we augmented with autogenous fascia lata graft to reconstruct an irreparable rotator cuff tear.

Tendon transfers are frequently used in the treatment of massive and irreparable rotator cuff tears. The latissimus dorsi tendon has become the preferred option for tendon transfer in massive, unrepairable posterosuperior cuff tears, and successful clinical outcomes have been reported.<sup>1–5</sup> However, there is some controversy regarding latissimus dorsi tendon transfer (LDT). Because of its vertically oriented force vector, the LDT is not expected to provide a native shoulder joint restoration. Anatomically, lower trapezius tendon transfer (LTTT) has become a better option for restoring an inadequate posterosuperior rotator cuff because the force vector mimics the natural infraspinatus tendon. The lower trapezius transfer

(LTT) became popular after reports by Elhassan et al.<sup>6–8</sup> LTT may be preferred in the treatment of massive irreparable cuff tears that are not accompanied by degenerative arthritis. The LTT has superior biomechanical and clinical advantages to LDT including an in-line transfer with a more favorable line of pull and an in-phase transfer that is easier for patients to retrain.<sup>9</sup> The line of pull of the infraspinatus is similar to the lower trapezius. Lower trapezius mimics the infraspinatus more anatomically than LDT.

In this Technical Note, we aim to demonstrate the arthroscopic-assisted LTT with fascia lata autograft.

## Surgical Technique

### Patient Positioning

Under general anesthesia, the patient is placed in a lateral decubitus position, lying on the contralateral side to be operated, with a pillow between the knees. Anterior and posterior kidney-shaped supports keep the patient in this position.

### Shoulder Arthroscopy

Beginning with a diagnostic arthroscopy, rotator cuff tear is examined to ensure that primary repair is not feasible (Video 1). Because the subscapularis tendon must be intact or primarily repairable to perform trapezius tendon transfer, it must also be carefully examined. If necessary, primary repair of the subscapularis is performed (Table 1).

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Received March 16, 2024; accepted May 24, 2024.

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2212-6287/24450

<https://doi.org/10.1016/j.eats.2024.103143>

**Table 1.** Pearls and Pitfalls for Arthroscopic-Assisted Lower Trapezius Transfer Technique

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If there is a subscapularis tear, it must be repaired first.
To obtain sufficient tendon length, the lower trapezius tendon should be cut as lateral to the insertion site as possible.
The lower trapezius muscle should be released ventrally and dorsally, and adequate tendon excursion should be provided.
The spinal accessory nerve must be preserved while separating middle and lower parts of the trapezius.
A sufficiently wide tunnel should be created between the spina scapula and infraspinatus muscle fibers to facilitate graft passage.
To prevent insufficient graft tensioning, the arm should be in abduction and external rotation position while suturing the lower trapezius tendon and fascia lata graft.

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### Harvesting of Autogenous Fascia Lata Graft

The length of the fascia lata graft highly depends on the height and body measurements of the patient. It typically ranges from 10 to 13 cm. The distance between the medial border of the spina scapula and the greater tubercle of the humerus in the scapular oblique coronal plane on magnetic resonance imaging can be used to estimate the required graft length as a practical method (Fig 1). A width of 2 or 2.5 cm is usually enough.

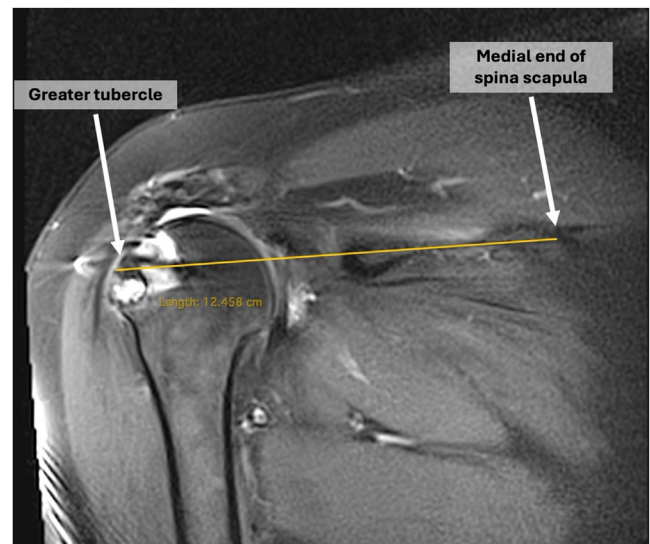
An incision is made beginning 5 cm inferior to the greater trochanter, extending distally. If a tendon harvesting hand tool with an adequately sized knife is available, a smaller incision compared with the length of the graft to be harvested can be used. At this point, regardless of the equipment used, the longitudinal incisions in the fascia lata should be precisely parallel to its fibers (Fig 2A). As the graft is obtained, the long gap on the fascia lata must be repaired primarily to avoid any risk of herniation of the muscles underneath.

### Preparation of the Graft

To provide a good tendon-bone contact, the proximal end of the graft should be employed at the humeral side fixation, which is slightly thicker than the distal end. This proximal end is tubularized beforehand by folding the graft's proximal 3 cm into 2 or 3 layers (Fig 2B). As this tubular shape is being preserved, 2 independent continuous nonlocking free sutures are applied to the proximal end of the graft. The free ends of 1 suture leave the graft at the proximal end, whereas the free ends of the other suture exit the graft on the lateral side near its end (Fig 2B). The free ends of both sutures should be of comparable length to be transported in the joint and fixated on the humerus easily.

### Detaching Trapezius From the Insertion

An incision oblique to the medial part of the spina scapula is performed, to reach scapular insertion of the



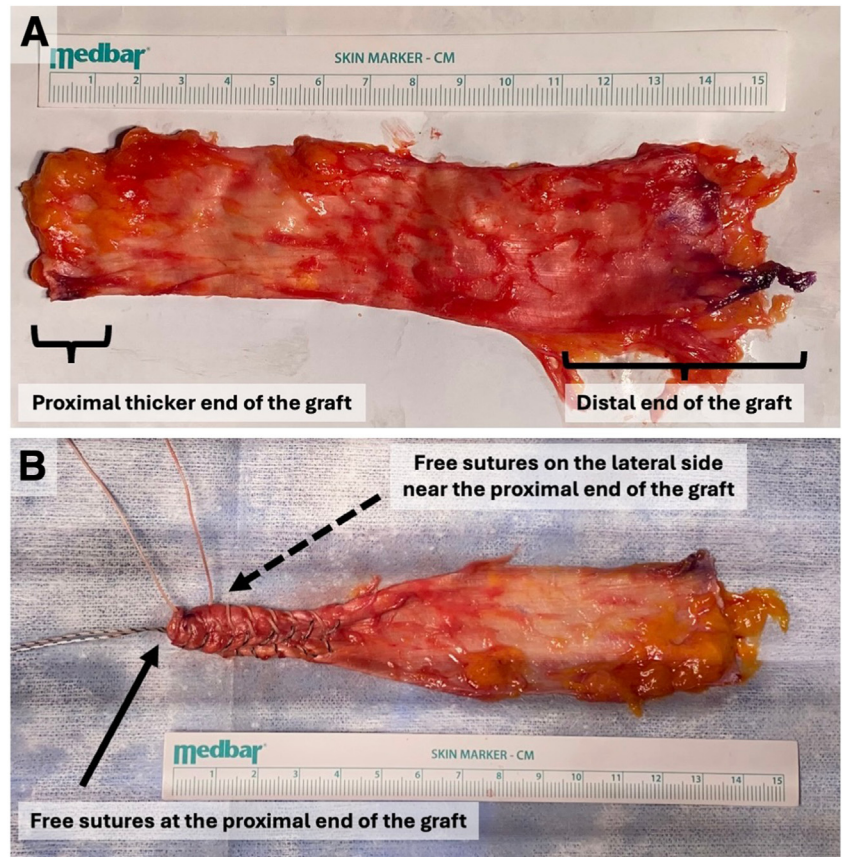
**Fig 1.** A 30° oblique coronal section of magnetic resonance imaging of the right shoulder of a lower trapezius transfer patient. As a practical method for the estimation of required length of the fascia lata autograft to be used for lower trapezius transfer, the distance between the medial border of the spina scapula and the greater tubercle of the humerus is measured in 30° oblique coronal plane parallel to the scapular plane on preoperative magnetic resonance imaging. It typically ranges from 10 to 13 cm.

lower trapezius muscle (Fig 3). Insertion of the tendon is reached through a blunt dissection, and the No. 5 suture is passed through it for further manipulation without harm. Then the trapezius is dissected from its insertion. Dorsal and ventral sides of the muscle body is released from adjacent soft tissues with blunt dissection. While separating middle and lower parts of trapezius, the spinal accessory nerve must be preserved to obtain a functional lower trapezius (Table 2). The nerve is usually found 3 cm medial to the medial edge of the scapula and near the deep surface of the muscle. Excursion and free gliding of the released tendon is controlled (Fig 4).

### Intra-articular Transportation and Fixation of the Autograft to the Humerus

A tunnel is created between the trapezius and subacromial space. Gently, blunt dissection is performed between the lower edge of the spina scapula and infraspinatus muscle body (Fig 5A). A clamp is extended into subacromial space through this tunnel (Figure 5B). At this point, it is crucial to take care the neurovascular bundle beneath infraspinatus. A loop monofilament suture is inserted through the anterior portal and pulled out of the incision on the medial scapula by passing through this tunnel (Fig 5C). The graft's free suture ends are initially pulled out from the anterior portal retrovertly, followed by the

**Fig 2.** View of the harvested fascia lata autograft for lower trapezius tendon transfer. (A) Longitudinal incisions made while harvesting the fascia lata graft should be precisely parallel to its fibers, as seen in this example. (B) Proximal end of the tendon, which will then be fixed on the humerus, is folded longitudinally to obtain a tubular shape. Two independent, continuous, nonlocking free sutures are applied to this end. Note that free ends of one suture leave the graft at the proximal end (arrow with continuous line), while free ends of the other suture leave it on the lateral side near its end (arrow with dashed line).



proximal end of the graft being transported intra-articularly (Fig 5D).

The graft is fixated on 2 points of the greater tubercle, via the free suture ends leaving the graft and 2 knotless anchors (Doratek Knotless Anchor by Doratek Medical Inc., Ankara, Turkey). Suture ends leaving the graft from its end are fixated just posterior to the biceps groove and the other ones leaving at the side are fixated posteriorly, 1 cm lateral to the cartilage border.

### Suturing the Graft and Trapezius Distal End

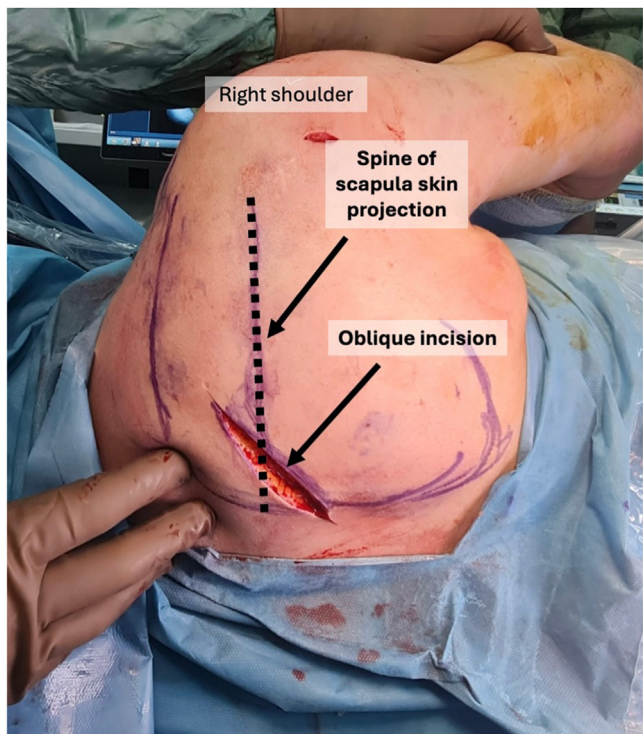
After fixation of the proximal end of the graft on the humerus, the arm is abducted and externally rotated approximately 90° to be able to adjust the tension of the trapezius-graft unit properly (Fig 6A). Finally, the wider distal end of the fascia lata graft is sutured to the stump of the lower trapezius (Fig 6B).

### Discussion

The present surgical technique describes arthroscopic-assisted LTTT combined with minimally invasive surgery. The use of autogenous fascia lata graft shows the different and prominent feature of this technique.

Massive irreparable rotator cuff tear is a definition used to describe cuff pathology, which is basically characterized by advanced muscle atrophy, Goutallier stage III/IV fatty infiltration, and poor tendon quality.<sup>10</sup> Treatment of massive irreparable rotator cuff tears remains as challenging for surgeons today as it was in the past, and there is a wide spectrum of treatment options such as partial repair, debridement, subacromial spacers, tendon transfers, superior capsular reconstructions, tendon augmentations, and arthroplasty.<sup>9-12</sup> Tendon transfers are dynamic methods that are preferred in relatively younger patients who do not have degenerative changes. LTT, which Elhassan et al.<sup>13</sup> first applied to patients with brachial plexus injury in 2009, began to be a treatment option in patients with massive irreparable rotator cuff tear in the following years. LTTT has begun to yield clinically satisfactory results and has begun to become a method comparable to LTD. Particularly as a result of biomechanical studies, it has been observed that superior results are obtained compared with LTD in irreparable posterosuperior cuff tears.<sup>14,15</sup> One of the biggest advantages of this method is that the pulling direction of the lower trapezius is the same as that of the infraspinatus.<sup>9</sup>

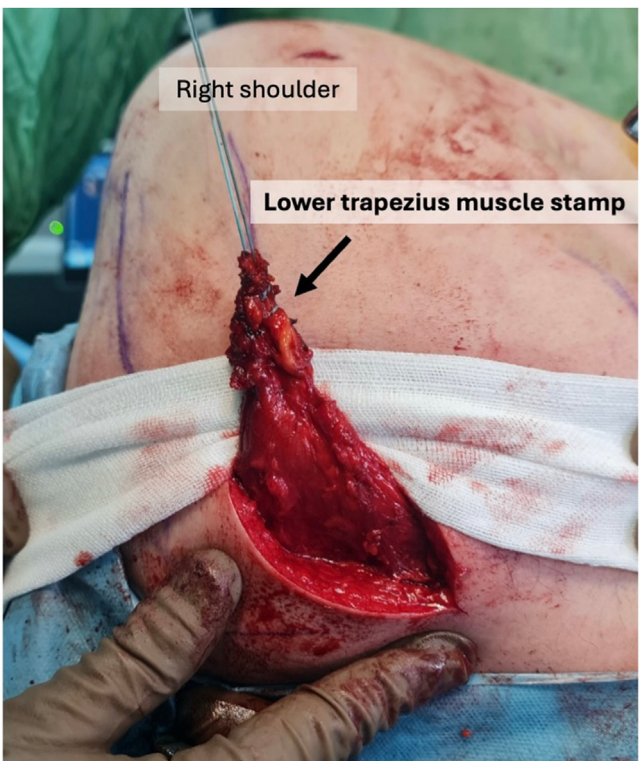




**Fig 3.** The patient is in lateral decubitus position. The incision oblique to the right medial spine of scapula is seen in the figure. Dotted line represents projection of spine of scapula on the skin.

LTTT has begun to become a more preferred method compared with LDT due to reasons such as having an external rotation that mimics the function of the posterosuperior cuff better than the latissimus dorsi tendon and having a synergistic effect on scapular retraction and shoulder external rotation.<sup>7-9,14,15</sup> LTTT also has some disadvantages. Short excursion and the need for a tendon graft between the trapezius tendon and the greater tuberosity of the humerus are the prominent disadvantages of this surgical method.

Achilles tendon allograft is the preferred tendon option for LTTT in the original technique described by Elhassan et al. However, the biggest disadvantage of using this tendon is that it is expensive.<sup>7,8,16</sup> Hamstring



**Fig 4.** The right lower trapezius stump is seen in the patient lying in the lateral decubitus position. Through the oblique incision on the medial spine of scapula, insertion of lower trapezius tendon is exposed, dissected, and hung with a No. 5 suture. Excursion and free gliding of the released tendon is controlled.

tendons and peroneus longus are other options used in surgery.<sup>16-18</sup> We prefer the fascia lata as a graft. The advantages of using this tendon are that it is easily accessible and is technically easy to apply. However, the biggest disadvantage of using the fascia lata is that it requires additional incisions and causes comorbidities. We fold a part of the fascia lata that attaches to the humerus onto itself and stitch it. Thus, we make the distal part that attaches to the footprint relatively thicker. Biomechanical studies examining the use of the fascia lata in lower trapezoid transfer are also needed. In our own clinical experience, we

**Table 2.** Advantages and Disadvantages of the Arthroscopic-Assisted Lower Trapezius Transfer Technique Compared With Other Surgical Treatment Options

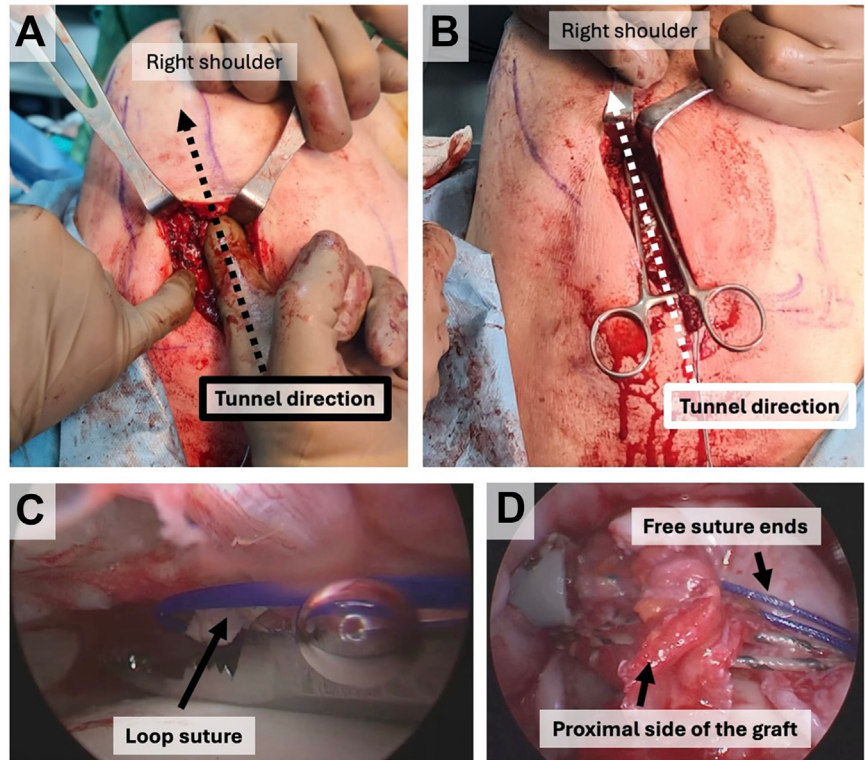
Advantages

- A minimally invasive and arthroscopic-assisted surgery
- Use of an autogenous graft and no graft costs
- The force vector of the trapezius tendon mimics the natural infraspinatus tendon.

Disadvantages

- Requires advanced arthroscopic skills
- Possible presence of additional comorbidities due to autogenous graft harvesting because the lower trapezius tendon cannot reach the tuberculum majus

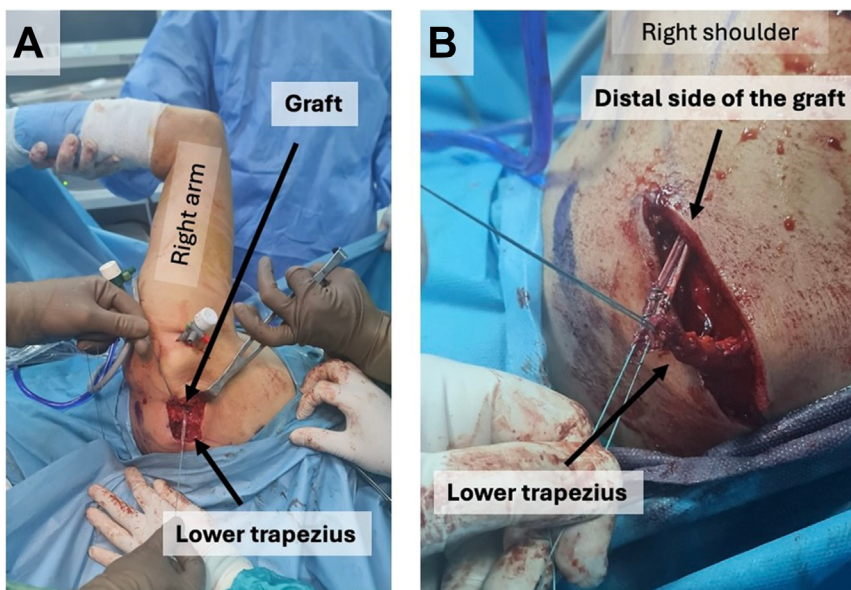
**Fig 5.** (A) Gentle, blunt dissection is performed between the lower edge of spina scapula and infraspinatus muscle body to create a tunnel between the lower trapezius insertion and proximal humerus. At this point, it is crucial to take care of the neurovascular bundle beneath infra-spinatus muscle. (B) A long clamp is extended into subacromial space through this tunnel. (C) Viewing through the lateral portal, a loop monofilament suture placed through the anterior portal is grasped and drawn out of the incision on the scapula by passing through the tunnel created. (C) From the same point of view, the graft's free suture ends are initially delivered to the anterior portal. Then proximal end of the graft is transported to joint cavity.



have been using the fascia lata as a graft for approximately 2 years. We have not encountered any negative clinical and radiological result.

In conclusion, this technique is minimally invasive and can be easily applied. Fascia lata autograft can be preferred because it is an easily accessible and

inexpensive graft option. The fact that the pulling direction of the posterosuperior cuff and the trapezius is the same indicates the biomechanical advantage of this technique. However, further clinical studies are necessary to determine the overall outcomes of this procedure.



**Fig 6.** (A) The arm is abducted and externally rotated approximately 90° to be able to adjust the tension of the trapezius tendon—fascia lata graft unit properly before suturing them to each other. (B) The wider distal end of the fascia lata graft is sutured to the detached stump of the lower trapezius tendon with the modified Kessler technique.



## Disclosures

All authors (B.S., B.B., M.O., U.K.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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