

An Arthroscopic Humeral Medializing Repair of the Supraspinatus



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Abstract: Posterosuperior repair of the rotator cuff is one of the most frequently performed surgical procedures in the shoulder. Its aim is to fix the tendon back to the bone to restore anatomy, improve shoulder function, and prevent progression of cuff tear arthropathy and attendant muscle degeneration. Despite technical advances in this procedure, in some cases, the tendon cannot be fixed back to the footprint without excessive tension on the repair. In young patients or in patients with low-grade muscle atrophy and fatty degeneration (Goutallier grade 1 or 2), it is mandatory to attempt fixation of the tendon to restore functional anatomy and prevent further muscle degeneration. In such cases, an arthroscopic medialized reinsertion of the supraspinatus may be considered. We describe an arthroscopic humeral medializing repair of the supraspinatus tendon that allows for a tension-free repair of the supraspinatus using common portals and instruments. The goal of this technique is to obtain tendon healing, restore functional anatomy, and prevent atrophy and fatty degeneration of the muscles of the rotator cuff.

Many studies in the literature have reported that an anatomic repair of the ruptured supraspinatus tendon back to its footprint is important to obtain adequate healing and function after cuff tear surgery.¹ In some cases it is not possible to obtain sufficient tendon excursion to allow fixation of the supraspinatus tendon back to its anatomic position on the greater tuberosity. In such cases a number of alternative technical procedures have been previously described in the literature²⁻⁵: margin convergence, latissimus dorsi transfer, cuff patch augmentation, or superior capsular reconstruction. The results of these techniques are still under evaluation; however, they all fail to adequately restore the functional anatomy of the muscles of the rotator cuff and so, in the absence of ongoing

mechanical stimulation, condemn the supraspinatus muscle to further degeneration and fatty infiltration.

For such patients with a tendon defect, midsubstance tear, or re-tear after surgery in the presence of fatty infiltration of less than grade 2 (Goutallier classification), we propose a humeral medializing repair of the supraspinatus tendon (HUMEREP) as a viable surgical option (Figs 1 and 2, Video 1). The HUMEREP is a simple technique using common portals and instruments. It allows a tension-free repair of the cuff and prevents cuff tear extension and fatty degeneration of the rotator cuff muscle.

Surgical Technique

Diagnostic Arthroscopy

We perform shoulder arthroscopy with the patient in the beach-chair position. The arm is placed in forward flexion with no traction system. The glenohumeral cartilage, cuff tendons, and biceps are inspected through a posterior portal. The full-thickness supraspinatus tear and its footprint are visualized.

With a grasper, the torn cuff is manipulated to ascertain the extent and direction (medially, anteriorly, or posteriorly) of any retraction. In this manner we may then assess the reducibility of the tendon and the potential for achieving a tension-free repair to the native footprint.

Biceps Management

If the biceps tendon is weak or unstable or if the posterior biceps pulley is torn with the anterior part of

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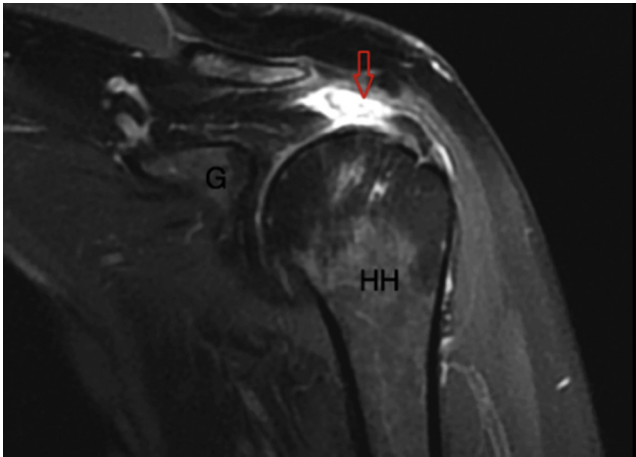


Fig 1. Coronal view of the right shoulder on magnetic resonance imaging showing a midsubstance tear (arrow) of the supraspinatus tendon with severe retraction. (G, glenoid; HH, humeral head.)

the supraspinatus, a biceps tenotomy or tenodesis is indicated. The tenotomy is performed from a lateral portal through the cuff defect.

In the case of tenodesis, intra-articular fixation is performed. An anchor is placed at the top of the bicipital groove by use of a rotator interval portal. Through the same portal, we use CleverHook devices (Mitek, Raynham, MD) to fix the tendon using the lasso-loop technique. The proximal part of the tendon is then cut with electrocautery.

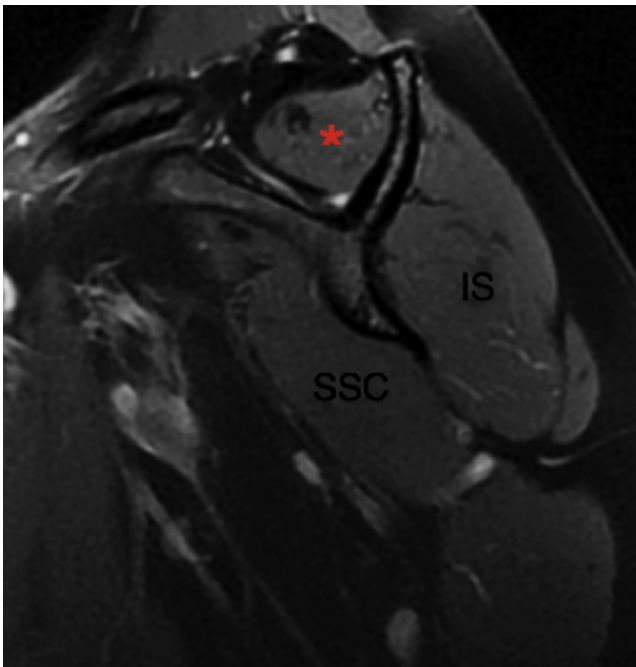


Fig 2. Sagittal scapular Y-view of the right shoulder on magnetic resonance imaging showing no fatty degeneration (asterisk) of the supraspinatus muscle. (IS, infraspinatus muscle; SSC, subscapularis muscle.)

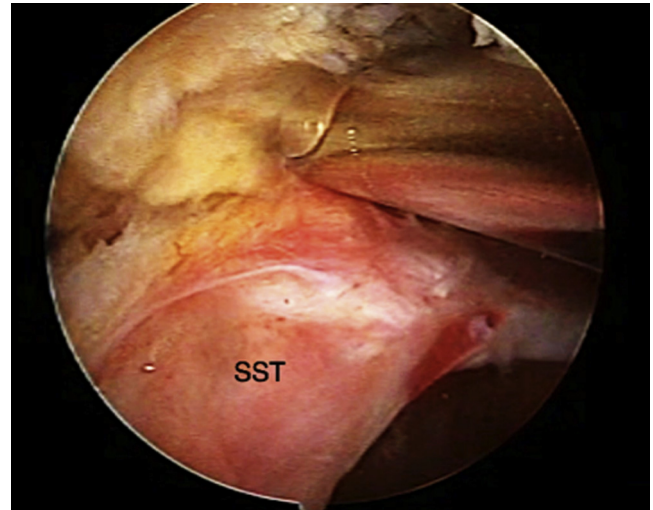


Fig 3. Lateral view of the right shoulder with the patient in the beach-chair position showing superficial release of the supraspinatus tendon (SST) with bursectomy and scapular spine visualization.

Generally, in patients younger than 50 years, a tenodesis is performed. In older patients and/or in the presence of a degenerative biceps tendon, a tenotomy is indicated.

Supraspinatus Tendon Release

If necessary, we perform a subacromial release (Fig 3) and a peri-glenoid capsulotomy (Fig 4) using electrocautery, through a lateral portal, to release adhesions of the supraspinatus tendon (SST). Occasionally, an anterior release of the tendon from the coracohumeral

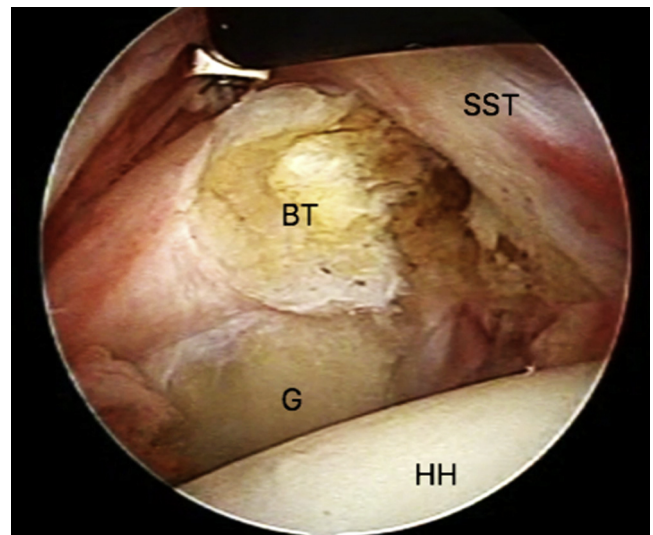


Fig 4. Lateral view of the right shoulder with the patient in the beach-chair position showing peri-glenoid release of the supraspinatus tendon (SST) with capsulotomy and release of the coracohumeral ligament. (BT, biceps tendon; G, glenoid; HH, humeral head.)

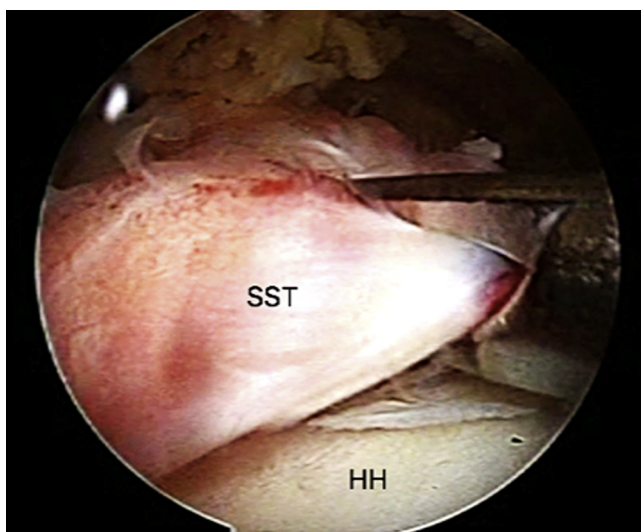


Fig 5. Lateral view of the right shoulder with the patient in the beach-chair position showing reducibility testing of the supraspinatus tendon (SST). The retracted tendon cannot be fixed on the footprint. (HH, humeral head.)

ligament and/or coracoid is also required through the same portal.

Reducibility Testing of Cuff

After supraspinatus release, if the tendon cannot be reduced to allow tension-free fixation to at least the medial one-third of the native footprint, then a medialized repair of the cuff tear is indicated (Fig 5). In our experience we consider it vital to insert the arthroscope through the posterolateral portal to allow a global overview of the tendon tear from the subacromial space.

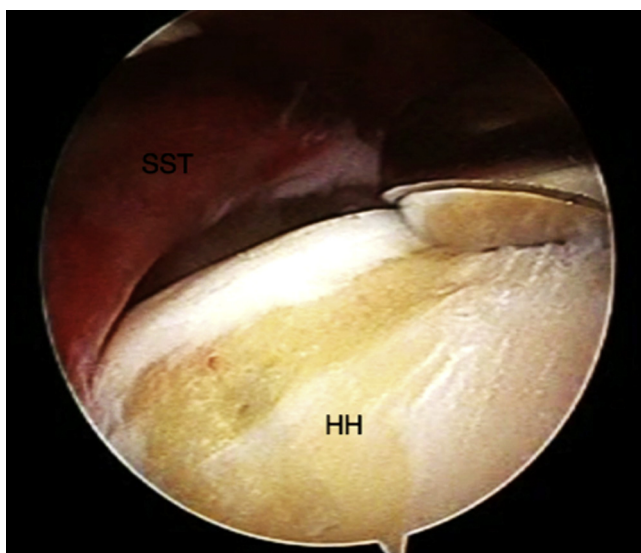


Fig 6. Lateral view of the right shoulder with the patient in the beach-chair position showing bone bed preparation with preservation of subchondral bone. (HH, humeral head; SST, supraspinatus tendon.)

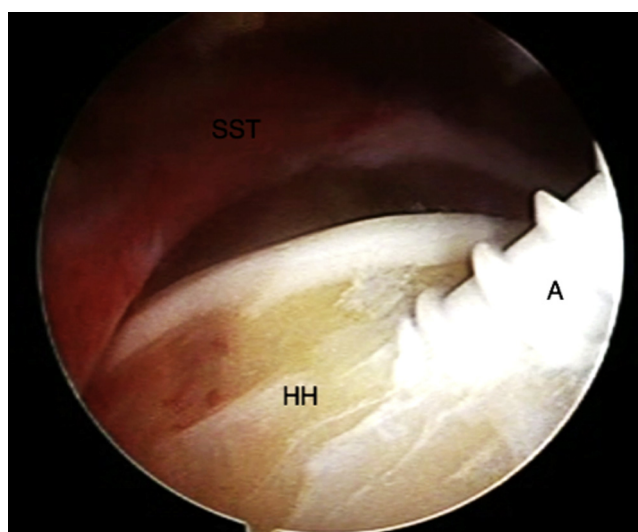


Fig 7. Lateral view of the right shoulder with the patient in the beach-chair position showing anchor (A) positioning in the humeral head (HH). (SST, supraspinatus tendon.)

The cuff may then, once again, be mobilized in all directions to further ascertain the direction of any remaining retraction. The subscapularis and infraspinatus tendons must also be exposed and examined to confirm the absence of concomitant pathology. In the presence of fatty infiltration of less than grade 2, if it is not possible to achieve tendon contact with at least the medial one-third of the native footprint, then we opt to perform an HUMEREP.

Bone Bed Preparation and Anchor Positioning

The humeral head cartilage is debrided by use of a full-radius blade with a Tornado Handpiece (Mitek). It is vital to remove only the cartilage to expose the

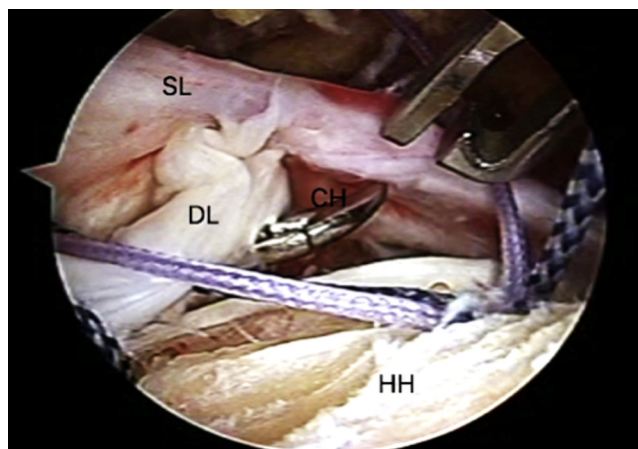


Fig 8. Lateral view of the right shoulder with the patient in the beach-chair position showing suturing of the superficial layer (SL) and deep layer (DL) of the delaminated supraspinatus tendon with a CleverHook (CH). (HH, humeral head.)

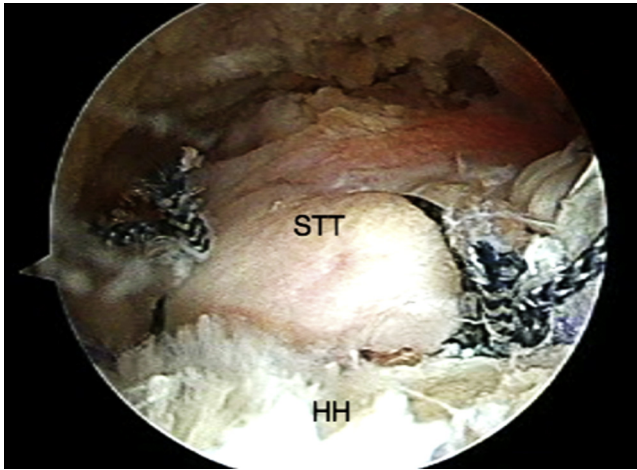


Fig 9. Lateral view of the right shoulder with the patient in the beach-chair position showing the final aspect of the supraspinatus tendon (SST) after humeral medializing repair with Mason-Allen sutures. (HH, humeral head.)

subchondral bone (Fig 6). In our experience this bone is strong enough to allow very stable anchor placement. Two or three Healix Advance 4.5-mm anchors (Mitek) are placed in the humeral head, at approximately 1-cm intervals, depending on the size of the cuff tear and the native footprint being replicated (Fig 7).

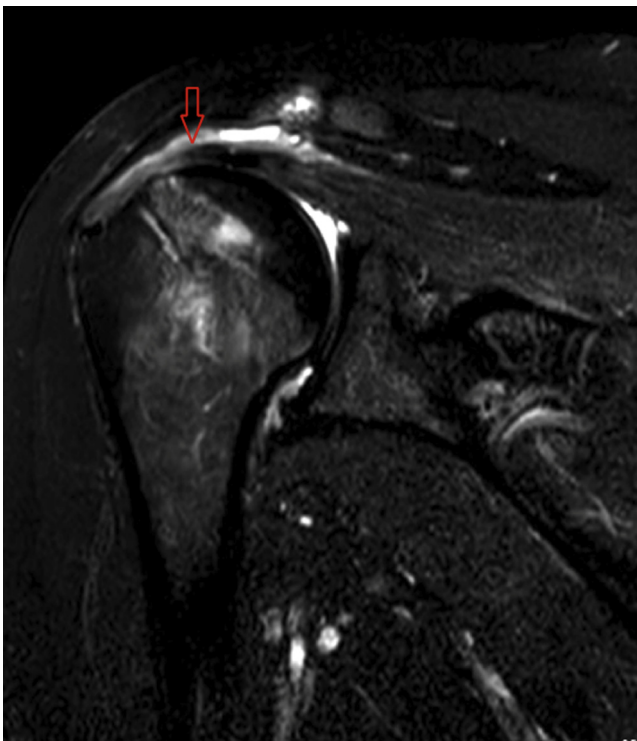


Fig 10. Postoperative coronal view of the right shoulder on magnetic resonance imaging after humeral medializing repair of the supraspinatus tendon, showing good healing of the tendon (arrow).

Table 1. Pearls and Pitfalls of HUMEREP Technique

Pearls

- Subacromial release of the supraspinatus and a peri-glenoid capsulotomy should be performed to improve tendon excursion.
- Coracoacromial ligament release and acromioplasty should be performed in a Bigliani type 2 or 3 acromion.
- The subchondral bone should be retained for stable anchor placement in the humeral head.
- All layers of the torn tendon end should be included in the suture repair, starting with the posterior anchor.

Pitfalls

- HUMEREP should be avoided in the case of cuff tear arthropathy and/or significant fatty infiltration of the rotator cuff (Goutallier grade ≥ 3).
- Patients should be required to use an abduction sling for shoulder immobilization.

HUMEREP, humeral medializing repair of supraspinatus tendon.

Supraspinatus Repair

A single-row repair of the supraspinatus to this medialized footprint is performed with CleverHook devices, by use of anterior and posterior portals. Because of muscle retraction and/or a tendon defect, in most cases we use a Mason-Allen suture technique for the tendon repair. It is vital to repair all tendon layers, particularly in the presence of tendon delamination (Fig 8). With this technique, it is not possible to perform a double-row repair (Fig 9).

Acromioplasty

The arthroscope is inserted through the lateral portal. The coracoacromial ligament is detached from the posterior portal with electrocautery. A burr is then introduced into the subacromial space through the same portal. The anterolateral edge of the acromion is removed with the burr to reduce any subacromial impingement in a Bigliani type 2 or 3 acromion. If an HUMEREP cannot be performed and the acromio-humeral interval is narrowed (<6 mm), as previously recommended,⁶ we do not perform an acromioplasty or release of the coracoacromial ligament to prevent superior migration of the humeral head.

Table 2. Advantages and Disadvantages of HUMEREP Technique

Advantages

- Simple technique using common portals and instruments
- Tension-free repair of rotator cuff
- Prevention of atrophy and fatty degeneration of rotator cuff muscles
- Ability to consider other techniques (LD transfer, patch, and so on) is retained in case of failure

Disadvantages

- Not possible in presence of significant supraspinatus muscle atrophy (Goutallier grade ≥ 3)
- Limitation of range of motion
- Single-row repair

HUMEREP, humeral medializing repair of supraspinatus tendon; LD, latissimus dorsi.

Postoperative Protocol

Postoperatively, the shoulder is immobilized in a sling with an abduction pillow for 1 month. Pendular exercises with passive and active rehabilitation can then be gradually introduced.

We routinely perform magnetic resonance imaging 3 months after surgery to visualize tendon healing (Fig 10). Pearls and pitfalls of the HUMEREP technique are shown in Table 1, and advantages and disadvantages are listed in Table 2.

Discussion

The principal advantages of the HUMEREP are as follows: It is a simple procedure that allows a tension-free repair off the rotator cuff using common portals and instruments. It prevents cuff tear extension and fatty degeneration of the rotator cuff muscle.

Goutallier et al.⁷ reported the importance of a tension-free repair of the cuff. They described a technique lateralizing the muscle—a technical procedure that is still the subject of some debate; however, the concept of decreasing tension in the repaired rotator cuff was introduced. As we describe in this report, arthroscopically, it is much simpler to achieve a similar goal on the tendon side by medializing the tendon footprint and so allowing a tension-free repair of the retracted or deficient supraspinatus tendon.

Over-tensioning is associated with ongoing shoulder pain and poor functional outcomes. If the tendon cannot be reduced to the footprint in a tension-free manner, 3 main arthroscopic procedures have been described: latissimus dorsi tendon transfer, margin convergence, and patch augmentation.

Latissimus dorsi tendon transfer is technically challenging, has a high rate of complications,⁸ and requires a long postoperative rehabilitation. Margin convergence does not adequately restore muscle function and is associated with poor functional outcomes.⁹ Patch augmentation techniques have a number of drawbacks: lack of availability of the patch, high costs, and potential for graft rejection. The patch is not fixed to the tendon, and therefore muscle function is not restored.

The main potential drawback of medialization of the supraspinatus insertion is limitation of range of motion after healing. In 2003 Kessler et al.¹⁰ reported on a partially medialized repair of the cuff, fixing the tendon at the bone-cartilage junction in massive retracted tears. They reported good healing and clinical outcomes. Medialization of more than 10 mm of the supraspinatus tendon attachment site has been shown to significantly decrease glenohumeral joint motion in cadaveric studies.^{11,12}

Midsubstance tears are often seen after needling of calcific tendinitis. Retear is the main complication after traditional arthroscopic rotator cuff tear repair.¹³ In these cases, if fatty infiltration of the muscle belly is less

than grade 2 (Goutallier classification), we present the HUMEREP as a viable alternative to the previously discussed salvage options. The HUMEREP is the only technique for such cases that restores rotator cuff functional anatomy.

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