Arthroscopic Subscapularis Repair Through a Single Anterior Portal

Jonathan D. Barlow, M.D., M.S., and Joshua S. Everhart, M.D., M.P.H.

Abstract: Arthroscopic subscapularis repair with knotted suture fixation typically requires use of both anterior and accessory superolateral portals with passage of suture through multiple anatomic spaces. The advent of knotless anchors has allowed for simplification of subscapularis repairs. In this report we describe a simple method of knotless arthroscopic subscapularis repair through a single anterior portal. The indication for a single—anterior portal knotless subscapularis repair is a complete tear of the upper one-third of the subscapularis. This approach can be used for isolated subscapularis repair or, in patients with multiple-tendon involvement, initial subscapularis repair to facilitate subsequent posterosuperior cuff repair.

The subscapularis tendon is the only anterior tendon of the rotator cuff, and even isolated subscapularis repairs can cause significant morbidity.1 It contributes more to arm elevation strength than the supraspinatus or infraspinatus.2 Subscapularis tears are also commonly present in patients who undergo arthroscopic rotator cuff repair. Arai et al.3 reported a 27.4% prevalence of subscapularis tears in a large consecutive series of patients who underwent arthroscopic rotator cuff repair. Repair of the subscapularis can facilitate posterosuperior cuff repair and decrease tension on adjacent supraspinatus repairs.4

The most common tear pattern is disruption of the upper portion of the subscapularis tendon, which inserts on the upper margin of the lesser tuberosity.1,3 Physical examination alone can miss a large portion of subscapularis tears in the office; Barth et al.5 reported 40% of arthroscopically diagnosed tears had normal examination findings, and the bear-hug test was the most sensitive clinical examination finding, at 60%. When present, evidence of a medially displaced biceps tendon on axial magnetic resonance imaging is a highly specific finding for a subscapularis tear (Fig 1).3

Arthroscopic subscapularis repair has been considered technically difficult because of limited visualization of the anterior shoulder with a 30° arthroscope, as well as limited working room within the subcoracoid space. With use of a 70° arthroscope and an accessory anterolateral portal, Denard and Burkhart6 described a technique for improved visualization and manipulation of the subscapularis tendon. However, with the advent of knotless suture anchors, it is possible to simplify the surgical approach. In this report we describe a technique for arthroscopic subscapularis repair using a single standard anterior working portal in the rotator interval.

Technique

The illustrative case in this technique description is a high-grade subscapularis tear. On examination, there is notable weakness and pain with bear-hug testing. On magnetic resonance imaging, there is detachment of the superior subscapularis and accompanying medial subluxation of the biceps tendon out of the bicipital groove (Fig 1). The planned procedure is arthroscopic subscapularis repair followed by subpectoral biceps tenodesis.

The single—anterior portal arthroscopic subscapularis repair requires a similar sequence of steps as is recommended by Denard and Burkhart6 for the anterior and/or accessory anterolateral portal technique (Table 1). In addition to the standard 30° arthroscope, a 70° arthroscope is required, as is a suture-anchor combination that allows for knotless fixation (Table 2).
prefer to repair the subscapularis as the first step in rotator cuff repair because it is completed from an intra-articular position. A diagnostic arthroscopy is first performed with the 30° arthroscope. After standard diagnostic arthroscopy, the arm is placed in flexion and internal rotation. With the 30° arthroscope and a posterior lever push, the insertion of the subscapularis can be visualized. If the subscapularis insertion is normal, no further investigation is necessary. If there is continued concern about a subscapularis tear, switching to the 70° arthroscope will allow a more thorough investigation of the insertion (Table 3).

If a tear is identified, the biceps tendon is tenotomized. Given the association between the lateral subscapularis tendon insertion and the medial bicipital groove, we recommend tenodesis of the biceps in all cases of subscapularis repair. The biceps can be fixed to the subscapularis anchor, in a soft-tissue technique, or with an anchor high in the groove. In this example the cut biceps is left in situ in the bicipital groove and a subpectoral tenodesis will be performed later.

Throughout the subscapularis repair, the surgeon can switch between 30° and 70° arthroscopes as needed. The 70° arthroscope provides a much better view of the subscapularis footprint and subcoracoid space. In this case there is a definite tear of the upper border of the subscapularis with involvement of the footprint at the upper margin of the lesser tuberosity as viewed with the 30° arthroscope (Fig 2). We prefer to begin with the 30° arthroscope, using this for diagnostic arthroscopy, initial assessment of the subscapularis insertion, biceps tenotomy, rotator interval debridement, and placement of an anterior working portal. We use the 70° arthroscope for detailed assessment of the subscapularis insertion, soft-tissue releases medial to the glenoid, coracoplasty when necessary, lesser tuberosity preparation, and subscapularis repair (Table 3).

**Soft-Tissue Releases**

The rotator interval is released. We begin working just superior to the subscapularis tendon. We proceed lateral to the conjoint tendon and/or coracoacromial ligament, and laterally to the comma tissue. Perform a 3-sided soft-tissue release to improve subscapularis excursion. Avoid extensive dissection superficial and/or inferior to the subscapularis given the axillary nerve’s proximity. Pass suture through the upper one-third of the tendon. Note that the upper rolled border is often medially displaced. Prepare the bone bed of the lesser tuberosity; secure suture with a knotless anchor. Continue with rotator cuff repair, possibly including biceps tenodesis.

**Table 1. Key Points**

| Key Points                                                                 |   |
|---------------------------------------------------------------------------|---|
| Perform diagnostic arthroscopy with a 30° arthroscope.                   |   |
| Perform biceps tenotomy (with or without later tenodesis).               |   |
| Assess the subscapularis. Evaluate the footprint, particularly the upper margin of the lesser tuberosity, with a 70° arthroscope. Look for disrupted comma tissue or biceps subluxation. |   |
| Release the rotator interval medially to the coracoid, anteriorly to the conjoint tendon and/or coracoacromial ligament, and laterally to the comma tissue. |   |
| Perform a 3-sided soft-tissue release to improve subscapularis excursion. Avoid extensive dissection superficial and/or inferior to the subscapularis given the axillary nerve’s proximity. |   |
| Pass suture through the upper one-third of the tendon. Note that the upper rolled border is often medially displaced. |   |
| Prepare the bone bed of the lesser tuberosity; secure suture with a knotless anchor. |   |
| Continue with rotator cuff repair, possibly including biceps tenodesis. |   |

**Table 2. Equipment Required**

| Equipment Required                                                                 |   |
|-----------------------------------------------------------------------------------|---|
| 30° and 70° arthroscopes (Karl Storz, Tuttingen, Germany)                          |   |
| QuickPass SutureLasso                                                              |   |
| FiberTape                                                                          |   |
| 4.75-mm SwiveLock C anchor                                                         |   |

![Fig 1](image-url) (A, B) Axial magnetic resonance imaging of an upper subscapularis tear in a right shoulder. There is disruption of the upper subscapularis fibers near the tendon insertion at the upper margin of the lesser tuberosity, resulting in medial displacement of the biceps tendon from the bicipital groove (arrows).
Once the interval is released, a grasper can be used to assess tension on the subscapularis and obtain a better view of the rolled border of the subscapularis. At this point, we will typically place an anterior working portal (large enough for a suture lasso) and switch to the 70° arthroscope. We then perform a 3-sided release (anterior, superior, and posterior) of the tendon to improve excursion. These releases were described in detail by Denard and Burkhart.6 The anterior release is performed by skeletonization of the posterolateral corner of the coracoid, releasing adhesions between the coracoid and anterior subscapularis. The superior release is performed between the tendon and coracoid neck. Finally, the posterior release is performed with a 15° elevator or cautery between the posterior tendon and anterior glenoid neck.

**Bone Bed Preparation and Fixation**

Once the soft-tissue releases have been performed, tendon excursion is almost always sufficient to pull the intact superior border to the lesser tuberosity footprint (Fig 3, Video 1). Medialization is rarely necessary in upper-border subscapularis tears.

Next, a 25° QuickPass SutureLasso (Arthrex, Naples, FL) is used to pass suture through the upper one-third of the intact subscapularis tendon (Fig 3, Video 1). We use the curved trocar (left lasso in a right shoulder and vice versa) to pass the lasso through the upper rolled

---

**Fig 2.** (A) View of the anterior shoulder with a 30° arthroscope from a standard posterior viewing portal. A right shoulder is visualized with the patient in the beach-chair position and the arm in a neutral position. There is a tear of the upper subscapularis with involvement of the lesser tuberosity insertion. (B) The biceps tendon is routinely tenotomized before the subscapularis tear is addressed. The rotator interval is released just superior to the subscapularis tendon before a 3-sided soft-tissue release is performed to improve tendon excursion. (BT, biceps tendon; G, glenoid; HH, humeral head; RInt, rotator interval; Ssc, subscapularis.)
border of the tendon. To use 1 portal, extra lasso is passed into the joint. When abundant lasso is passed into the joint, the trocar for the lasso is slowly withdrawn from the cannula, with additional lasso advanced as this is withdrawn. This leaves looped lasso in the joint. It can then be retrieved with a suture grasper through the same cannula. A FiberTape suture (Arthrex) is passed through the lasso. The “non-passed” end of the lasso can then be pulled to shuttle the FiberTape through the upper border of the subscapularis. These sutures can be loaded into a knotless anchor (we prefer a 4.75-mm biocomposite SwiveLock C anchor [Arthrex]).

With slack taken out of the FiberTape, the upper margin of the lesser tuberosity is prepared (Fig 4, Video 1). An arthroscopic shaver or motorized burr can be used to prepare the bone bed (Fig 4). The tuberosity should be debrided back to healthy bleeding bone to enable healing. Additional tuberosity preparation techniques can be used as desired at this point.

A punch is placed at the superior margin of the lesser tuberosity and followed by anchor placement (Video 1). Moderate tension must be kept on the suture during anchor placement to fully reduce the tendon to the lesser tuberosity. The loose suture ends are then cut; no knots are required for this anchor. If desired, the eyelet retention sutures from this anchor could then be used for biceps tenodesis.

Rehabilitation is guided by the size of the tear and associated patient factors. For isolated upper one-third subscapularis tears (with or without small associated posterosuperior rotator cuff tears) or patients at increased risk of postoperative stiffness (preoperative frozen shoulder, calcific tendinitis, or concomitant labral repair), we will initiate passive external rotation and table slides at 2 weeks after surgery. A 30° external rotation limit is maintained for 6 weeks. All patients stay in a sling except during range-of-motion exercises with no lifting and no active strengthening for 6 weeks after surgery. For large or massive rotator cuff tears, we
prefer 6 weeks of immobilization, followed by 6 weeks of passive range of motion (again with a 30° external rotation limit), before adding strengthening.

**Discussion**

Excellent outcomes have been documented for patients after arthroscopic subscapularis repair. Some surgeons hesitate to repair subscapularis tears given concerns about swelling, time, and loss of visualization due to fluid extravasation from the anterosuperolateral portal. This single-portal technique simplifies arthroscopic subscapularis repair and, when used for the appropriate indication, has several advantages over the 2-portal technique (Table 4). It allows use of the familiar anterior working portal and minimizes issues with fluid extravasation from additional capsulotomies for accessory portals. This is important when performing soft-tissue releases of the subscapularis because the subcoracoid space is sensitive to soft-tissue edema and visualization can quickly become limited (Table 3). In addition, minimizing fluid extravasation will improve visualization of the subacromial space if subsequent posterosuperior cuff repair is to be performed. Sutures do not need to be shuttled between portals with the single–anterior portal technique, avoiding tissue bridges that can occur with the 2-portal technique. The use of a knotless anchor simplifies and shortens the surgical time involved in fixation. This technique can be used for most subscapularis repairs that involve the upper portion of the subscapularis insertion. In most cases the upper rolled border of the subscapularis medial to the tear is composed of healthy

---

**Fig 4.** Bone bed preparation and tendon repair, viewed with a 30° arthroscope. A right shoulder is visualized with the patient in the beach-chair position and the arm internally rotated. (A) Once the suture is passed, mild tension is placed on the suture to pull the tendon away from the subscapularis footprint. A shaver is used to prepare the bone bed at the upper border of the lesser tuberosity. (B) A punch is used on the upper border of the tuberosity. (C) The SwiveLock C anchor is introduced and slack taken out of the FiberTape. (D) Once the anchor is placed, the intact tendon should be fully reduced to the lesser tuberosity. (HH, humeral head; LT, lesser tuberosity.)
tendon, and there is sufficient tendon excursion after a 3-sided soft-tissue release to secure the subscapularis with a single suture without excessive tension on the repair. Subscapularis repair is performed with nonabsorbable suture,\textsuperscript{6,8} and to date, there are no clinical studies showing improved outcomes with a specific product. Denard and Burkhart\textsuperscript{6} described use of FiberTape for single-row repairs or FiberWire (Arthrex) for double-row repairs in an hourglass configuration (SutureBridge; Arthrex). For the single-portal knotless technique, it is our preference to use 2-mm FiberTape because there are slightly better pull-through strength characteristics in a rotator cuff biomechanical model.\textsuperscript{9} In the minority of cases in which the surgeon may discover intraoperatively that the subscapularis tear is more extensive or tissue quality is poor, an accessory anterolateral portal can be easily added.\textsuperscript{6} Conversion from an initial single-portal approach to the 2-portal approach (anterior and accessory anterolateral) can be performed for retracted tears that require significant in-line traction with a traction stitch or if the tear may require a double-row repair\textsuperscript{8} or interlocking stitch\textsuperscript{10} if there is concern for suture pullout.

### References

1. Mall NA, Chahal J, Heard WM, et al. Outcomes of arthroscopic and open surgical repair of isolated subscapularis tendon tears. *Arthroscopy* 2012;28:1306-1314.
2. Kuechle DK, Newman SR, Itoi E, Morrey BF, An KN. Shoulder muscle moment arms during horizontal flexion and elevation. *J Shoulder Elbow Surg* 1997;6:429-439.
3. Arai R, Sugaya H, Mochizuki T, Nimura A, Moriishi J, Akita K. Subscapularis tendon tear: An anatomic and clinical investigation. *Arthroscopy* 2008;24:997-1004.
4. Ticker JB, Burkhart SS. Why repair the subscapularis? A logical rationale. *Arthroscopy* 2011;27:1123-1128.
5. Barth JR, Burkhart SS, De Beer JF. The bear-hug test: A new and sensitive test for diagnosing a subscapularis tear. *Arthroscopy* 2006;22:1076-1084.
6. Denard PJ, Burkhart SS. Arthroscopic recognition and repair of the torn subscapularis tendon. *Arthrosc Tech* 2013;2:e373-e379.
7. Denard PJ, Jiwani AZ, Lädermann A, Burkhart SS. Long-term outcome of a consecutive series of subscapularis tendon tears repaired arthroscopically. *Arthroscopy* 2012;28:1587-1591.
8. Nové-Josserand L, Hardy MB, Leandro Nunes Ogassawara R, Carrillon Y, Godenêche A. Clinical and structural results of arthroscopic repair of isolated subscapularis tear. *J Bone Joint Surg Am* 2012;94:e125.
9. Bisson LJ, Manohar LM. A biomechanical comparison of the pullout strength of No. 2 FiberWire suture and 2-mm FiberWire tape in bovine rotator cuff tendons. *Arthroscopy* 2010;26:1463-1468.
10. Kircher J, Schwalba K, Hedtmann A. The subscapularis interlocking stitch for the arthroscopic treatment of subscapularis tendon tears at the shoulder. *Arthrosc Tech* 2015;4:e531-e535.