

Knotless Arthroscopic Repair of Subscapularis Tendon Tears Using Looped Suture



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Abstract: Subscapularis tendon tears present a technical challenge because both diagnosis and arthroscopic treatment can be difficult. One difficulty is the limited visualization and working space of the anterior shoulder. Although most tears of the subscapularis are partial- or full-thickness tears of the upper third of the tendon, occasionally, larger or more retracted tears are encountered. Various techniques have been developed to treat a wide variety of tear patterns. We present a simple technique using a looped suture that remains easy to use in the limited working space of the anterior shoulder; can be easily modified to accommodate a broad spectrum of subscapularis pathology, from partial to full and retracted tears; and uses familiar viewing and working portals. This technique creates a single-row, knotless repair. Traction on the superior suture improves visualization and ease of passing more inferior sutures. Risks include unintentional over-tensioning of the repair and medialization of the femoral footprint, which can be avoided with appropriate exposure and arm positioning during repair. Postoperative care includes restriction of external rotation for 3 to 6 weeks and strengthening at 3 months.

Perhaps because standard arthroscopy from a posterior viewing portal with a 30° arthroscope does not well visualize the insertion of the subscapularis on the lesser tuberosity, lesions of the subscapularis were initially underdiagnosed and undertreated. Gradually, greater attention has been drawn to the high incidence of partial-thickness subscapularis tears and their association with other tears of the rotator cuff and long head of the biceps tendon pathology.¹

Early techniques for arthroscopic subscapularis repair were hindered by the limited visibility and working space in the anterior shoulder relative to the subacromial space. Pioneering work by Bennett^{2,3} detailed the arthroscopic anatomy of the subscapularis and rotator interval, making arthroscopic diagnosis easier. Most early techniques for repair required arthroscopic knot tying.⁴⁻⁷

More recently, Denard and Burkhart⁸ introduced a knotless technique using a FiberTape suture (Arthrex, Naples, FL) for subscapularis repair that is effective in the treatment of upper-third subscapularis tears. Unfortunately, this technique is not easily expanded to larger or more retracted tears, and other techniques have been recommended for larger full-thickness tears.^{9,10} Outcomes research has been limited but suggests that isolated repair of subscapularis tears can yield marked improvements in shoulder function, can significantly reduce pain, and can result in a durable structural repair.^{11,12}

We describe an arthroscopic technique for knotless subscapularis repair using a looped suture (FiberLink; Arthrex). This technique has the advantage of using one looped suture as a traction stitch to facilitate passage of a second suture, effectively removing tension on retracted tears during repair. In addition, use of a traction stitch more proximally can allow a second anchor to be placed more inferiorly using the same technique for larger full-thickness retracted tears. **Table 1** reviews the indications, key points, tips, pearls, pitfalls, risks, and aftercare.

Surgical Technique

Diagnostic Arthroscopy and Associated Procedures

A thorough diagnostic arthroscopy is critical to proper diagnosis and management. The patient is positioned in the beach-chair position, and diagnostic arthroscopy is performed through a standard posterior viewing portal.

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Table 1. Indications, Key Points, Tips, Pearls, Pitfalls, Risks, and Aftercare

Indications	PASTA (partial articular supraspinatus tendon avulsion) tears Full-thickness tears
Contraindications	Severe retraction or atrophy Avulsion fracture
Key points	Familiar viewing and working portals are used. A 30° arthroscope is typically adequate for superior-third tears. Looped suture facilitates secondary suture passage.
Tips	Biceps treatment should be performed first. Adequate debridement improves visualization. Understanding the anatomy of the anatomic footprint is critical.
Pearls	Traction on the superior looped suture through the anterolateral portal eases passage of more inferior suture. Use of a tap after a punch may ease anchor placement in hard bone.
Pitfalls and risks	Failure to externally rotate the arm to neutral before anchor placement leads to over-tensioning of the repair. Poor visualization can lead to inadvertent medialization of the footprint.
Aftercare	External rotation should be limited for 3-6 wk depending on tissue quality. Resistive exercises begin after 3 mo. Aftercare is often dependent on treatment of associated pathology.

In most cases a 30° arthroscope can be used, but in some cases, especially with retraction, a 70° arthroscope may be beneficial. Surgeons should be familiar with the comma sign and use of the “shuck maneuver,” internal rotation and posterior displacement of the humerus, for evaluation of the subscapularis and lesser tuberosity as have been previously described.¹⁰ Evaluation and treatment of associated long head of the biceps tendon pathology by the surgeon’s preferred technique (tenotomy or tenodesis) should be performed before initiation of subscapularis repair.

Most commonly, a subscapularis tear is either (1) a tear of the upper rolled border with avulsion off the lesser tuberosity, (2) a significant linear tear that is better seen with the shuck maneuver, or (3) a full-thickness tear with retraction (or some combination thereof). Once the need for repair has been established, 2 working (anterior and anterolateral) cannulas are inserted. The technique for repair is demonstrated in [Video 1](#).

Portal and Cannula Placement

The anterior portal should be placed such that the angle of approach is from medial to lateral just above the subscapularis tendon and toward the lesser tuberosity. At least a 7-mm cannula (Twist-In; Arthrex) is required to allow passage of a suture lasso suture-passing device. The Gemini cannula (8.25 mm)

(Arthrex) can also be used because of its ability to retract the soft tissue of the anterior capsule.

The anterolateral portal is placed in the rotator interval just anterior to the leading edge of the supraspinatus if there is no full-thickness supraspinatus tear. If there is a full-thickness supraspinatus tear, the portal can be placed through this full-thickness supraspinatus tear. In addition, this same superior lateral portal can be used later to help in repair of the supraspinatus tear from the subacromial view. It can also be used to help visualize the lesser tuberosity in larger retracted tears. Because this cannula is typically only needed for suture management and shuttling, a 5- to 6-mm cannula (Twist-In; Arthrex) can be used, although a 7-mm cannula provides the least resistance if space allows. [Figure 1](#) shows exterior and interior views of cannula placement.

The subscapularis tissue is debrided with an arthroscopic shaver. If significant adhesions are present, arthroscopic scissors may be used from the anterolateral portal to perform releases on the anterior, superior, and posterior surfaces of the tendon. The lesser tuberosity is similarly exposed, debrided, and prepared with an arthroscopic shaver.

Suture Passage

From the anterior portal, a 90° SutureLasso (Arthrex) is introduced and then used to puncture the tissue from anterior to posterior. The lasso wire is retrieved through the anterolateral portal, and the nonlooped end of the FiberSnare suture (Arthrex) is then shuttled through the proximal portion of the subscapularis tendon. This suture is retrieved and cinched through the anterolateral portal, and this can now be used as a traction stitch. Alternatively, a Scorpion suture-passing device (Arthrex) can be used from the anterolateral portal.

The process is then repeated as described earlier. However, the traction suture may now be used to aid in visualization, penetration (by way of countertraction), and passage of a more inferior and slightly more medial FiberSnare.

A SutureLasso is again introduced through the anterior portal and is used to penetrate the subscapularis tendon slightly inferior and more medial to the first FiberSnare assisted by traction on the first suture through the anterolateral portal. The wire is retrieved through the anterolateral portal, and again, the non-looped end of the FiberSnare is shuttled through the tendon. The looped end is then retrieved from the anterolateral portal through the anterior portal with a looped grasper so that cinching occurs exclusively in the anterior portal to prevent entanglement with the previously passed FiberSnare. The first traction stitch is then retrieved through the anterior portal (from the anterolateral portal), leaving both sutures cinched and located in the anterior cannula ([Fig 2](#)).

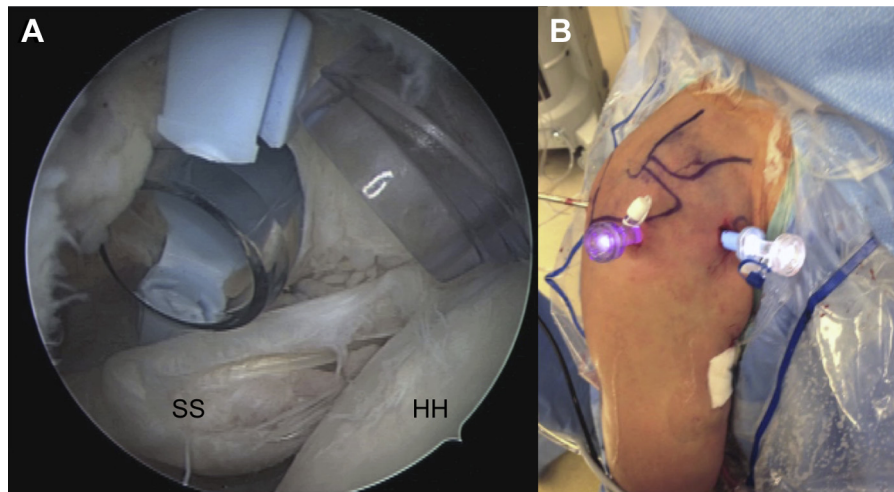


Fig 1. (A) Arthroscopic view of a right shoulder, with the patient in the beach-chair position, with the 30° arthroscope in the posterior viewing portal. The blue cannula is in the anterior portal and allows for retraction of the anterior soft tissues. The purple 7-mm cannula is in the anterolateral portal. (B) Exterior view of the same shoulder in the same patient with the arthroscope in the posterior viewing portal. The blue cannula is in the anterior portal, and the purple cannula is in the anterolateral portal. One should note that, in these images, a mini-open subpectoral tenodesis had been performed before planned arthroscopic repair of the subscapularis tendon. (HH, humeral head; SS, subscapularis tendon.)

Anchor Placement

To achieve the appropriate position and tension for the repair, the arm is placed in neutral to slight external rotation. This also allows the punch to be used without interfering with the head of the patient and will prevent over-tightening of the final subscapularis repair. The green-handled punch for the 4.75-mm SwiveLock

(Arthrex) is used through the anterior cannula to enter the lesser tuberosity at its anatomic insertion.

If there is resistance encountered with the punch, a tap can be used to facilitate anchor placement but in most cases is not necessary. The sutures that were retrieved through the anterior portal are then placed through the eyelet of the 4.75-mm SwiveLock. The anchor is placed in the previously prepared hole on the lesser tuberosity. The sutures are gently tensioned and then impacted, and finally, the anchor-suture construct is screwed into place.

An arthroscopic knot cutter is used to cut both sutures simultaneously to create a very low-profile knotless subscapularis repair (Fig 3). An additional FiberWire suture (Arthrex) comes loaded on the SwiveLock anchor and may be removed or incorporated into an augmentation of the repair. After repair, the arm is taken through its range of motion (internal and external rotation with the arm at the side) to confirm stability of the repair.

Variations for Larger Tears

For larger tears, the same technique may be used with a second anchor placed more inferiorly. In these cases a 70° arthroscope can greatly improve visualization of the more inferior aspect of the tendon. Placement of a superior FiberSnare initially provides improved control of the tissue and facilitates visualization and suture passage. The more inferior anchor should be placed first. The more superior anchor should then be placed second and the traction suture incorporated into the superior anchor to augment the repair. This allows a simplified, single-row technique for larger tears.

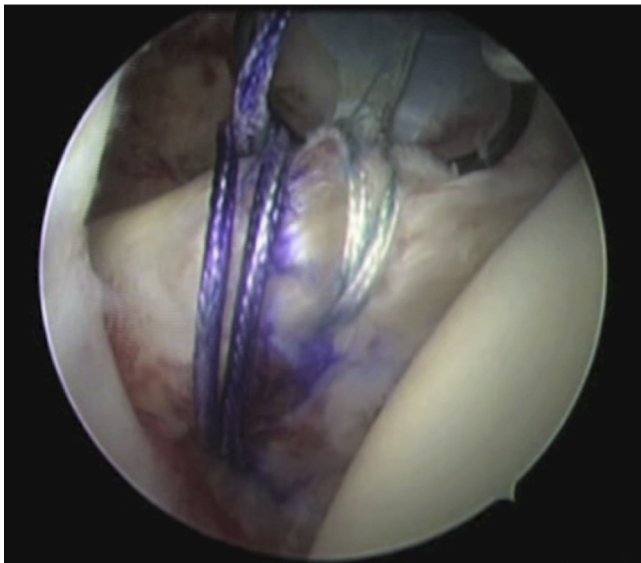


Fig 2. Arthroscopic view of a right shoulder, with the patient in the beach-chair position, with the 30° arthroscope in the posterior viewing portal. Both FiberSnare sutures have been passed through the subscapularis tendon and are positioned in the anterior portal in preparation for anchor placement. One suture has been colored with a sterile marking pen to facilitate suture management.

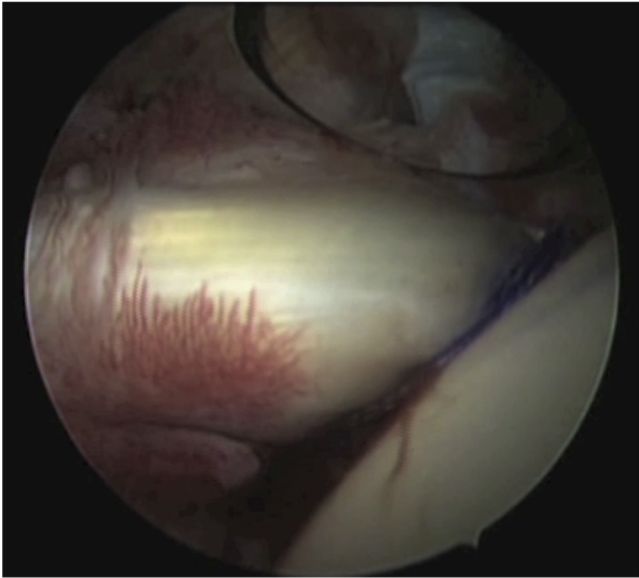


Fig 3. Arthroscopic view of a right shoulder, with the patient in the beach-chair position, with the 30° arthroscope in the posterior viewing portal. The final repair is shown after completion of anchor placement and cutting of suture tails.

Complications

In our experience no neurovascular complications have been encountered. However, there is a risk of rerupture that has been reported to be as high as 6% in previous studies of arthroscopic subscapularis repair.¹³

Aftercare

The postoperative protocol should be determined by the treatment of concomitant pathology and repairs. Regarding the subscapularis, for small tears, passive external rotation may be allowed immediately; however, if the tissue is poor quality or if the tear has shown significant retraction, the postoperative protocol is modified to limit external rotation for 3 to 6 weeks. Active external rotation with the arm at the side is generally restricted for 6 weeks, and resistive exercises begin after 3 months. If the described technique has been performed in combination with a biceps tenotomy, no further restrictions are placed; however, in the case of biceps tenodesis, active elbow flexion and strengthening may be restricted for 6 weeks.

Discussion

A primary advantage of our technique is that it can typically be performed with a 30° arthroscope in the posterior viewing portal and a standard anterior working portal. Use of common portals that are already familiar to most surgeons who perform glenohumeral arthroscopy may facilitate learning the technique more quickly than if other viewing or working portals or a 70° arthroscope was routinely required. Subscapularis tears are frequently associated with other pathology

(biceps tendinopathy or other tears of the rotator cuff); therefore a quick and effective technique for repair is ideal because it allows time for treatment of associated pathology before fluid distention limits visibility, particularly if the surgeon is working in the subacromial space.

One primary limitation of the described technique is that it creates a single-row repair. In some cases very large or retracted tears might benefit from a double-row repair, which has the advantage of re-creating a larger footprint. Biomechanical evaluation has suggested superior strength and stiffness with double-row repairs.^{9,14} However, double-row techniques frequently require accessory portals and the introduction of retractors not necessary with the approach we describe.¹⁵ In addition, in cases in which debridement of surrounding tissue and footprint preparation are inadequate or visualization is limited, there is a risk of medialization of the footprint of the subscapularis tendon. Even under these circumstances, previous studies of complete subscapularis tears repaired arthroscopically have suggested that medialization of 4 to 7 mm does not alter clinical outcomes.¹⁶

Knotless arthroscopic repair of subscapularis tendon tears using a looped suture is an effective treatment for a wide spectrum of subscapularis pathology. This technique combines the advantages of earlier techniques but can be easily modified to incorporate larger tears and allows for manual traction and reduction of retracted tears during repair. Further research is needed to determine clinical outcomes and compare biomechanical properties with other previously described techniques.

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