

Arthroscopic Subscapularis Tendon Repair Using the Lasso-Loop Technique Through Anterolateral Viewing Portal



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Abstract: The subscapularis is the strongest muscle among the rotator cuff muscles, and it provides a coupled balanced force across the glenohumeral joint by resisting the infraspinatus in axial plane and the shearing force of deltoid in the coronal plane. It is important to repair subscapularis tears to maintain the coupled balanced force. Subscapularis tendon tears are difficult to diagnose and treat. Only a small portion of the subscapularis tendon is visualized during routine arthroscopy, as it is largely covered by the middle and inferior glenohumeral ligaments. Various repair techniques have been described in the literature. Here, we describe the anterolateral viewing portal for better visualization of subscapularis and our preferred technique, the lasso-loop technique, which provides better tissue grip and improved functional outcome.

Subscapularis tendon tears were first described by Smith and recognized by Codman.¹ Hauser² reported the first case of subscapularis tendon repair in 1954. Various open techniques for the repair of the subscapularis tendon tears were described. Burkhart and Tehrani³ published the first arthroscopic technique of repair of subscapularis tendon tear in 2002.

With improvements in clinical examination and radiographic imaging studies, our ability to accurately diagnose subscapularis tears has improved, but the

recognition of partial tears is under-reported.⁴ The incidence of subscapularis tears was shown to be between 3% and 13% by autopsy and cadaveric studies.⁵ Subscapularis tears are hard to access, and they require advanced surgical techniques.⁶

Various repair techniques of torn subscapularis tendon have been described recently. Most of the recent literature has studied the outcome of arthroscopic subscapularis tendon repair using various techniques. Most of the studies used single-row/double-row repair or mattress sutures for arthroscopic subscapularis tendon repair.

In 2006, a new suture technique was introduced by Lafosse et al.⁶ to improve the tissue grip—the lasso loop stitch, which initially was described for the reattachment of the rotator cuff. It was also described for Bankart repair and biceps tenodesis.⁷ In 2010, Lafosse et al.⁶ described the arthroscopic repair of subscapularis tendon tear using the lasso-loop technique and mattress sutures and demonstrated good clinical outcome.

The anterolateral portal offers better visualization of the articular and bursal surface of the subscapularis tendon and aids in release of the retracted subscapularis tendon tears. In this Technical Note, we present our preferred technique of subscapularis repair—arthroscopic repair of subscapularis tendon using the lasso-loop technique through anterolateral viewing portal.

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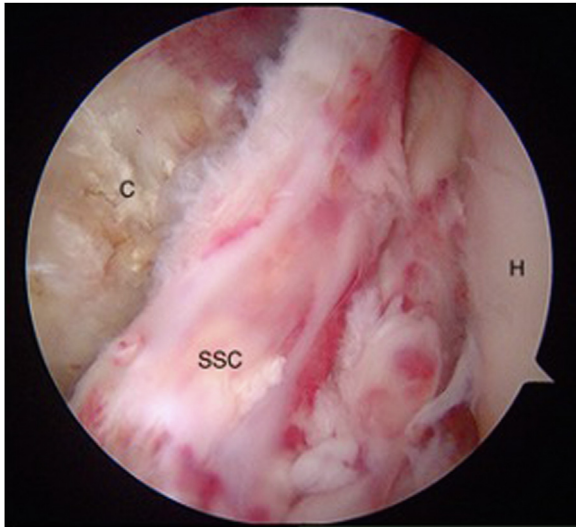


Fig 1. Patient shown in the lateral decubitus position. Posterior viewing portal established. Diagnostic arthroscopy through the posterior viewing portal showing Subscapularis tear. (C, coracoid; H, head of humerus; SSC, subscapularis.)

Surgical Technique (With Video Illustration)

Patient Positioning

Surgery is performed under general anesthesia and interscalene-block anesthesia. The patient can be positioned in either the beach-chair or lateral decubitus position. We position the patient in lateral decubitus position with the arm in 30° abduction and 20° flexion and traction. After sterile preparation and draping, bony landmarks are outlined.

Portal Placement

We use 3 portals: the standard posterior viewing portal, the anterior working portal, and an anterolateral viewing portal. A standard posterior portal is used to perform a routine diagnostic arthroscopy of the glenohumeral joint (Fig 1). The subscapularis tear is arthroscopically classified according to the Lafosse et al.⁶ classification to decide the treatment. The anterolateral portal is established at the leading edge of the supraspinatus tendon. A spinal needle is inserted into the glenohumeral joint at the leading edge of the supraspinatus tendon. A no. 11 blade is advanced collinear to the spinal needle into the glenohumeral joint. Make a capsulotomy with the no. 11 blade at the leading edge of the supraspinatus. Using a switching stick, a trocar cannula is inserted and anterolateral viewing portal is established (Fig. 2).

Subscapularis Release

Anterolateral portal offers better visualization of the articular and bursal surface of the subscapularis tendon. The retracted subscapularis tendon can be released

extensively on the articular and bursal surface by visualizing through the anterolateral viewing portal (Fig 3). At most, care should be taken to avoid injury to the axillary nerve at the bursal surface of the subscapularis tendon. The radiofrequency ablator probe should always be pointing upwards so that the tip can be visualized. A traction stitch placed in the tendon can assist in mobilization of the tendon, if the tendon is severely retracted. The tendon can be extensively released to achieve full excursion to its footprint on the lesser tuberosity to allow for a tension free repair.

Subscapularis Repair: The Lasso-Loop Technique

The lesser tuberosity is debrided and decorticated with radiofrequency ablator and burr before the placement of anchor (Fig 4). A double-loaded anchor (CEPTRE 4.8-mm PEEK suture anchor; Sironix Renewables, Seattle, WA) is placed into the lesser tuberosity at the subscapularis tendon footprint (Fig 5). One suture of the double-loaded anchor is employed for mattress suture in the inferior aspect of the tendon (Fig 6). The 2 limbs of the suture are retrieved using a suture shuttling device (Rhino suture passer, Arthrex, Naples, FL) through the inferior part of the tendon before creating the lasso-loop stitch in the superior aspect using the other suture (Fig 7). To create a lasso-loop stitch, select one limb of the suture (Fig 8) and retrieve a loop of the suture through the tendon using the suture shuttling device/bird beak to create a loop (Fig 9). Retrieve the

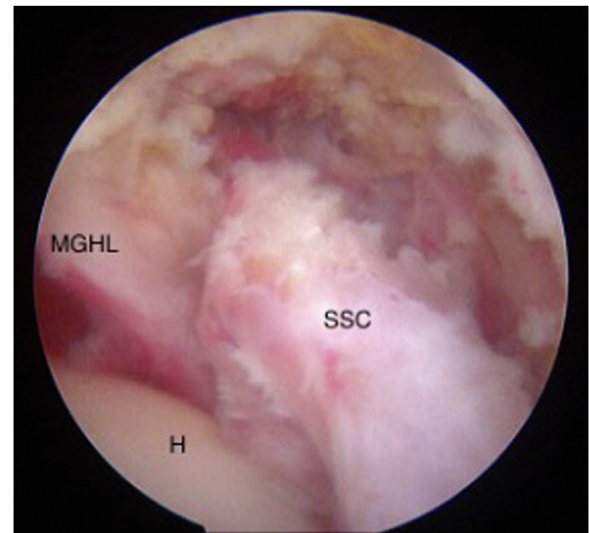


Fig 2. Patient shown in the lateral decubitus position. Viewing through the posterior portal, anterolateral portal is established at the leading edge of the supraspinatus tendon. Using a switching stick, the trocar cannula is inserted in the anterolateral portal and arthroscope inserted. The anterolateral viewing portal allows better visualization of the torn subscapularis tendon. (H, head of humerus; MGHL, middle glenohumeral ligament; SSC, subscapularis.)

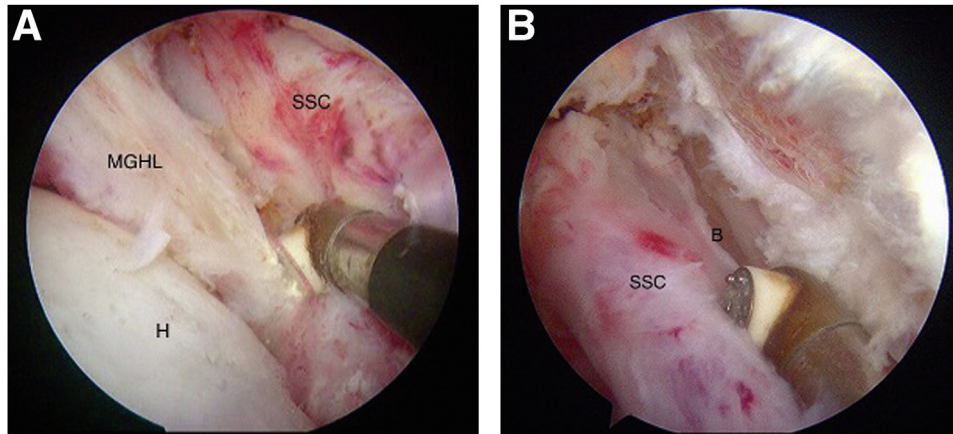


Fig 3. Patient shown in the lateral decubitus position. Viewing through the anterolateral portal and working through the anterior portal. Visualizing through the anterolateral viewing portal, the retracted subscapularis tendon can be extensively released both on the articular (A) and bursal surface (B). The middle glenohumeral ligament is released on the articular surface. While releasing the bursal surface of the subscapularis tendon, radiofrequency probe shoulder always be pointing upwards so the injury to the axillary nerve can be avoided. (B, bursal surface; H, head of humerus; MGHL, middle glenohumeral ligament; SSC, subscapularis.)

distal part of the same suture limb through the suture loop to form the lasso-loop stitch (Fig 10). Pull the other limb of the suture to tighten the lasso-loop stitch (Fig 11). Use an arthroscopic non-sliding knot to complete the lasso-loop stitch over the superior part of the tendon (Fig 12). The arm is placed in neutral position for proper tendon tensioning. The lower part of the tendon is repaired using vertical mattress suture over the bursal surface with the two limbs of the suture

retrieved initially (Fig 13). Thus, the lasso-loop stitch secures the superior part and the vertical mattress suture secures the inferior part of the subscapularis tendon (Fig 14). Once the subscapularis repair is completed, other pathologies can be addressed.

Postoperative Rehabilitation

The operated shoulder is immobilized in a sling for 4 to 6 weeks postoperatively. Wrist and elbow motions are encouraged during the period. Passive external rotation is permitted but limited to 0° or as determined during the surgery. Forward flexion exercises are initiated once the period of immobilization ends, progressing from active-assisted to active range of motion. Deltoid and rotator cuff strengthening exercises are started at 12 weeks postoperatively, with progressive return to functional activities and sports.

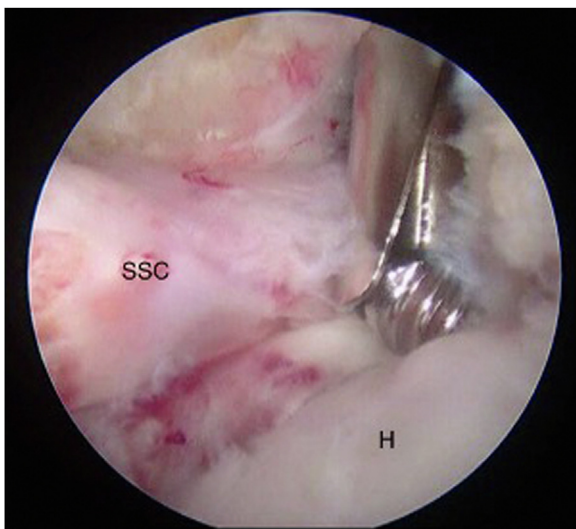


Fig 4. Patient shown in the lateral decubitus position. Viewing through the posterior portal. Working through the anterior portal. Subscapularis footprint at the lesser tuberosity is debrided and decorticated with radiofrequency ablator and burr before the placement of anchor. (H, head of humerus; SSC, subscapularis.)

Discussion

Codman¹ described the concept of coordinated rotator cuff muscle activity that maintain the humeral head in glenoid fossa. Subscapularis muscle plays a significant role in active stabilization of humeral head in the glenoid fossa during external rotation and abduction.^{8,9} The subscapularis muscle provides the coupled balanced force across the glenohumeral joint.¹⁰ It functions by resisting the infraspinatus in axial plane and the shearing force of deltoid in the coronal plane.^{10,11} When a subscapularis tear is left unrepaired, the function of the subscapularis muscle will be compromised. Furthermore, the posterosuperior rotator cuff tear repair will be difficult and less securely repaired.¹²

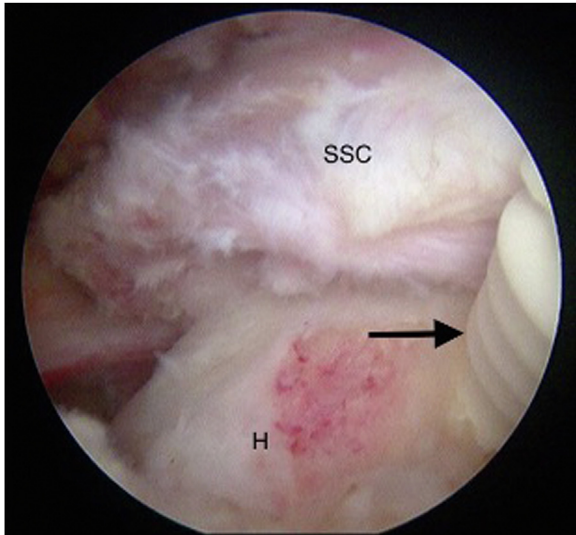


Fig 5. Patient shown in the lateral decubitus position. Viewing through the anterolateral portal and working through the anterior portal. A double loaded anchor is placed at the Subscapularis tendon footprint at the lesser tuberosity. Arrow shows the anchor inserted. (H, head of humerus; SSC, subscapularis.)

Arthroscopy remains the gold standard for the diagnosis of subscapularis tendon tears.¹³ Subscapularis repair techniques are technically demanding because of difficult visualization and instrumentation. Expertise in the arthroscopic examination of the shoulder have supplemented magnetic resonance imaging in

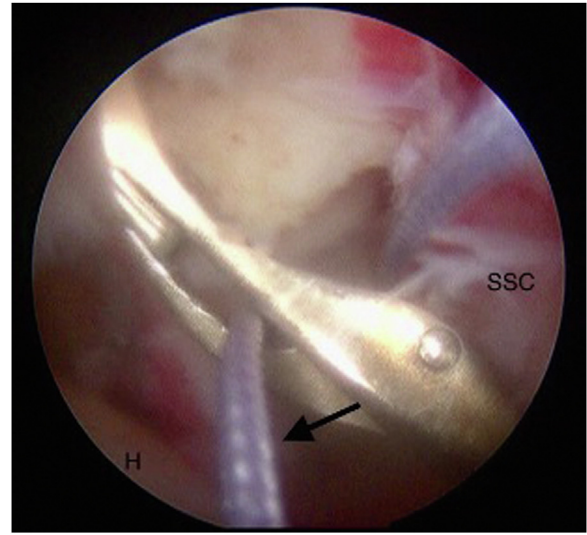


Fig 7. Patient shown in the lateral decubitus position. Viewing through the anterolateral portal and working through the anterior portal. One suture of the double-loaded anchor is selected for mattress suture. The selected limb of the suture is retrieved using a suture shuttling device or bird beak through the inferior part of the tendon. The arrow shows the selected limb of the suture. The other limb of the suture is also retrieved through the Subscapularis tendon in the same manner before creating the lasso-loop stitch. The suture is tied only after completing the lasso-loop stitch. (H, head of humerus; SSC, subscapularis.)

early and timely detection and treatment of even small tears of the subscapularis tendon. The comma sign is an arthroscopic finding indicating the presence of a

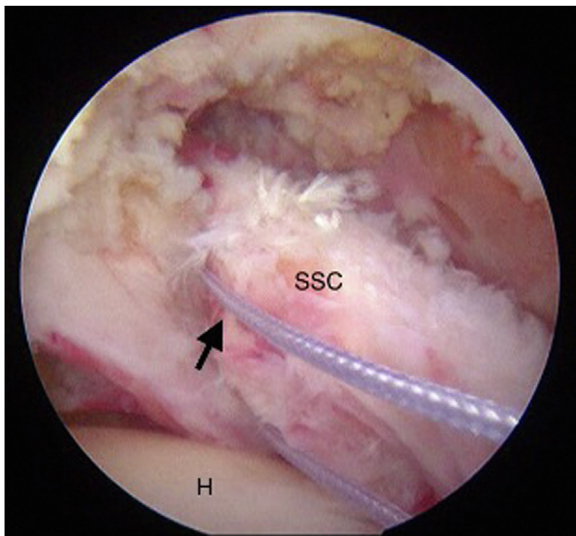


Fig 6. Patient shown in the lateral decubitus position. Viewing through the anterolateral portal and working through the anterior portal. One suture of the double-loaded anchor is selected for mattress suture in the inferior aspect of the tendon. Arrow shows the selected limb of the suture. (H, head of humerus; SSC, subscapularis.)

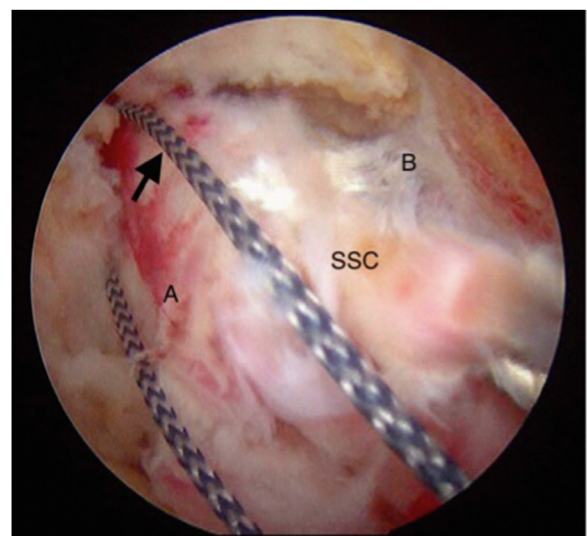


Fig 8. Patient shown in the lateral decubitus position. Viewing through the anterolateral portal and working through the anterior portal. One limb of the second suture of the double loaded anchor is selected for the lasso-loop stitch. The arrow shows the selected limb of the suture. (A, articular surface; B, bursal surface; SSC, subscapularis.)

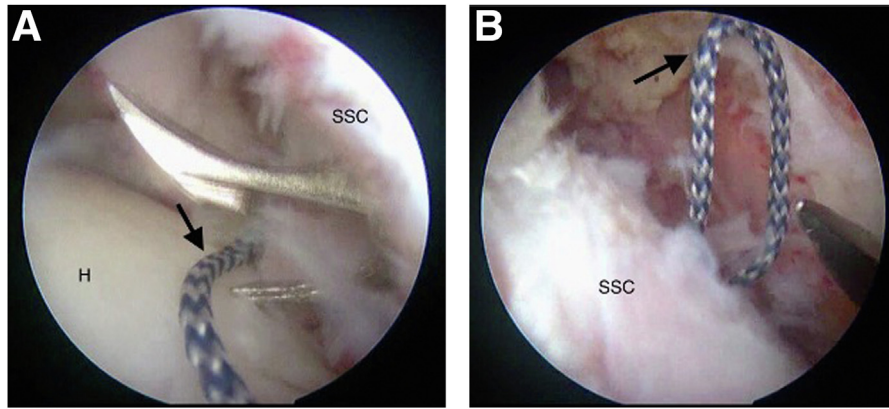


Fig 9. Patient shown in the lateral decubitus position. Viewing through the anterolateral portal and working through the anterior portal. One limb of the suture is selected for lasso-loop stitch. The selected limb of the suture is retrieved from the articular surface of the subscapularis tendon to create a loop at the bursal surface. The arrow shows the selected limb of the suture. (H, head of humerus; SSC, subscapularis.)

full-thickness subscapularis tears. It represents insertional fibers of superior part of subscapularis tendon torn horizontally from residual caudal fibers, with torn insertional fibers of the superior glenohumeral ligament and coracohumeral ligament retracted superiorly and medially in a vertical orientation, forming an abnormal vertical comma-shaped band obscuring the rotator interval. The sensitivity of identifying the comma sign on magnetic resonance imaging is 63%.¹⁴

Visualization of subscapularis tendon is important to obtain an ideal anatomical repair. Most often, a 70° arthroscope may be needed for adequate visualization of the tear and the subscapularis footprint on the lesser tuberosity.¹⁵ Establishment of an anterolateral viewing

portal may obviate the need for the switching of arthroscope. An anterolateral viewing portal provides excellent visualization of both the articular and bursal surface of the subscapularis. Retracted subscapularis tears can be extensively released along the articular and bursal surface through the anterolateral portal, as the neurovascular structures can be visualized better and safeguarded.

Various repair techniques of subscapularis tendon tears have been described in the literature. Of all the techniques, the lasso-loop technique described by Lafosse et al.⁴ provides better tissue grip and can be used especially in retracted subscapularis tears where the tendon can be reattached over the lesser tuberosity

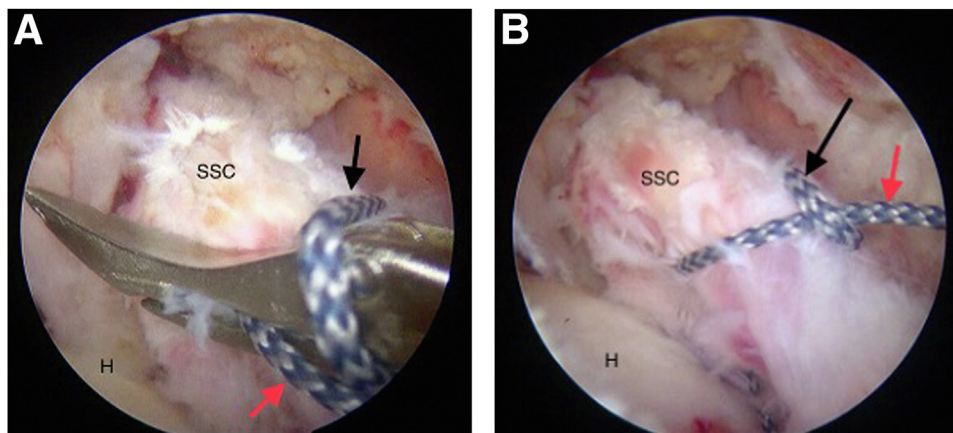


Fig 10. Patient shown in the lateral decubitus position. Viewing through the anterolateral portal and working through the anterior portal. One limb of the suture is selected and the same is retrieved from the articular surface of the subscapularis tendon to create a loop at the bursal surface. Retrieve the distal part of the same suture limb through the suture loop to create the lasso-loop stitch. The black arrow shows the loop. The red arrow shows the distal part of the suture limb. (H, head of humerus; SSC, subscapularis.)

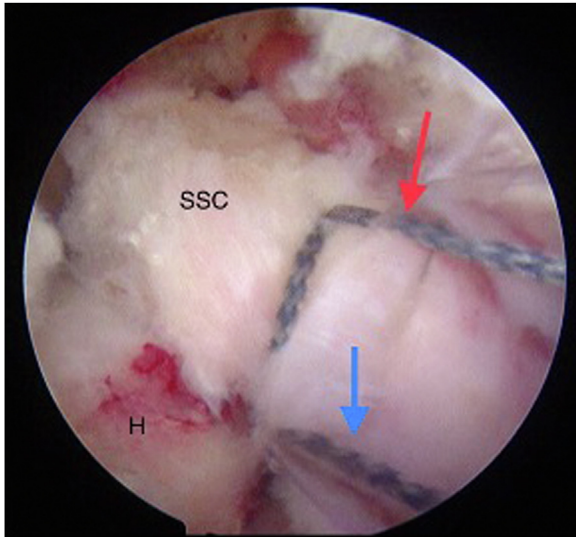


Fig 11. Patient shown in the lateral decubitus position. Viewing through the anterolateral portal and working through the anterior portal. Lasso-loop stitch is created with one limb of the suture. The second limb of the suture is pulled to tighten the lasso-loop stitch. The red arrow shows the lasso-loop stitch. The blue arrow shows the second limb of the suture. (H, head of humerus; SSC, subscapularis.)

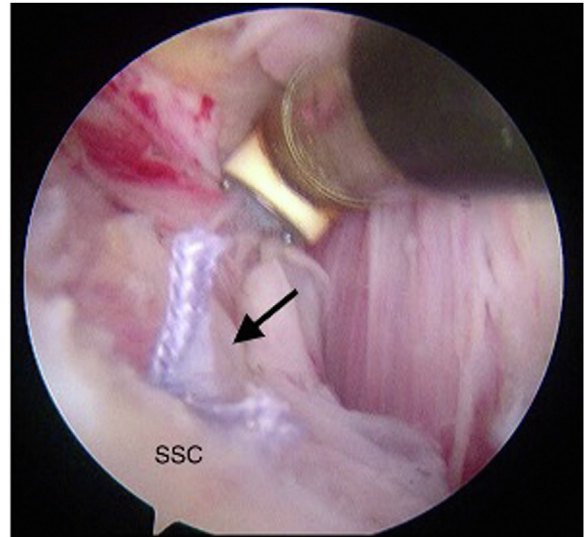


Fig 13. Patient shown in the lateral decubitus position. Viewing through the anterolateral portal and working through the anterior portal. After repairing the superior part of the subscapularis tendon using the lasso-loop technique, the lower part of the tendon is repaired using vertical mattress suture over the bursal surface with the two limbs of the suture retrieved initially. (SSC, subscapularis.)

with least chances of loosening of suture. In a recent systematic review done by Xiao et al.,¹⁶ the majority of the studies used single-row repair techniques. Of all the studies described, 2 studies done by Grueninger

et al.^{17,18} used the lasso-loop stitch. Although double-row repair techniques reported fewer retear rates, both single- and double-row repair techniques produce satisfactory outcomes clinically.¹⁶ Although technically demanding, the use of anterolateral viewing portal further simplifies the repair of subscapularis tendon tear, with better visualization of the torn tendon. The advantages and disadvantages of our techniques are

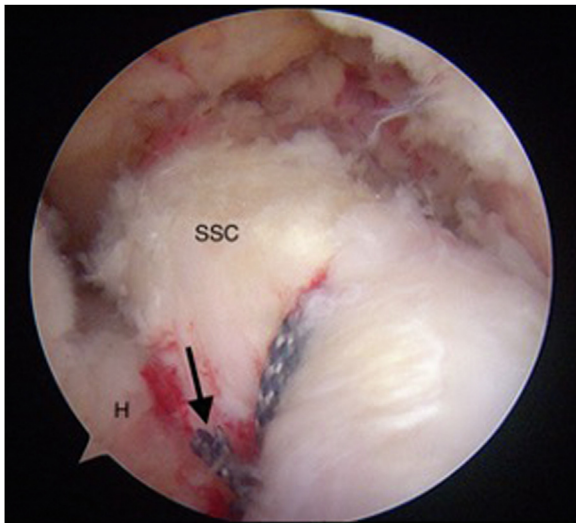


Fig 12. Patient shown in the lateral decubitus position. Viewing through the anterolateral portal and working through the anterior portal. Lasso-loop stitch is created with one limb of the suture and tightened by pulling the other limb of the suture. Tie using a non-sliding knot to complete the lasso-loop stitch over the superior part of the tendon. The arm is placed in neutral position for proper tendon tensioning. The black arrow shows the lasso-loop stitch secured with non-sliding knots. (SSC, subscapularis.)

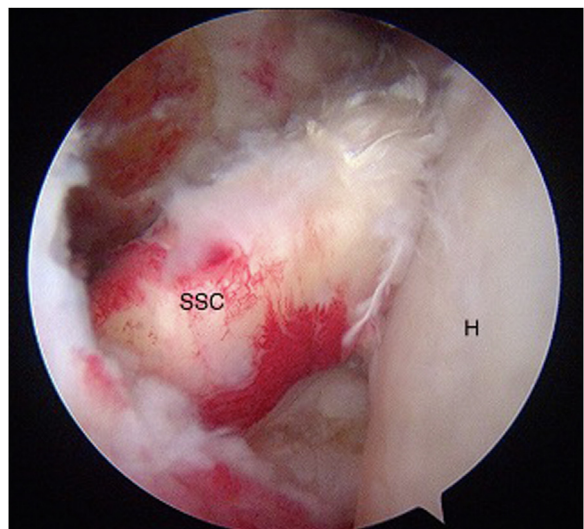


Fig 14. Patient shown in the lateral decubitus position. Viewing through the posterior portal showing repaired subscapularis tendon. (H, head of humerus; SSC, subscapularis.)

Table 1. Advantages and Disadvantages of Our Technique

Advantages	Disadvantages
<ul style="list-style-type: none"> • End on view of subscapularis tendon through the antero-lateral portal • Extensive release of retracted subscapularis can be done • Axillary nerve injury can be avoided during release due to better visualization of the bursal surface • Lasso-loop technique provides improved tissue grip and strong repair, especially in retracted tears • No need of switching from a 30° arthroscope to a 70° arthroscope, as the antero-lateral viewing portal provides adequate visualization with a 30° arthroscope 	<ul style="list-style-type: none"> • Technically demanding • Establishment of antero-lateral portal requires expertise

described in [Table 1](#). The surgical procedure is demonstrated in [Video 1](#).

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