



Arthroscopic Repair of a High-Grade Partial Articular-Sided Subscapularis Tendon Tear Without Bursal-Sided Tendon Overtension

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Abstract: The subscapularis tendon is one of the shoulder's primary anterior stabilizers along with capsulolabral tissues to prevent anterior dislocation and attaches to the lesser tuberosity. Subscapularis tendon ruptures can cause anterior shoulder pain and weakness of internal rotation. Patients with partial-thickness tears of subscapularis tendons who do not respond to conservative treatment may be candidates for surgical repair. The transtendon repair of a partial articular-sided subscapularis tendon tear, like the transtendon repair of a PASTA (partial articular supraspinatus tendon avulsion), can result in overtension and bunching of the bursal-sided subscapularis tendon. We propose an all-inside arthroscopic transtendon repair technique of a high-grade partial articular-sided subscapularis tendon tear without bursal-sided tendon overtension or bunching.

The subscapularis tendon, which attaches to the lesser tuberosity, is the largest of the rotator cuff tendons. It accounts for 50% of the rotator cuff. It is one of the shoulder's primary anterior stabilizers along with capsulolabral tissues to prevent anterior dislocation. Subscapularis tendon ruptures can cause anterior shoulder pain and weakness of internal rotation. Shoulder discomfort caused by a subscapularis tendon rupture is more anterior than the pain caused by other rotator cuff ruptures. The long head of the biceps tendon is frequently involved in the case of

subscapularis tears. In 63% with biceps tendon subluxation or dislocation, the subscapularis tendon is ruptured.¹

According to anatomic location and arthroscopy lesion-related findings, Lafosse proposed a 5-type categorization of subscapularis tendon tears. A type I tear is characterized by a partial tear of the upper part of the tendon with no separation from the bone. The upper one-third portion of the tendon detaches completely in type II tear. A type III tear is defined by the involvement of all tendon insertions without separation of the bottom third of the muscular part. The subscapularis tendon is separated entirely from the lesser tuberosity in type IV tear, and the humeral head is centered within the joint. The humeral head is translated anteriorly and superiorly in a type V tear.² Patients with partial-thickness tears of subscapularis tendons who do not respond to conservative treatment may be candidates for surgical repair. There are several methods for repairing the subscapularis tendon, such as open, arthroscopic, single-, and double-row techniques.³ Regardless of whether tears were single or double rows, combined or isolated, arthroscopic subscapularis repair led to significantly improved clinical outcomes.⁴

Similar to the transtendon repair of the PASTA (partial articular supraspinatus tendon avulsion), the transtendon repair of a partial articular-sided subscapularis tendon tear can produce overtension and bunching of the bursal-sided subscapularis tendon.⁵

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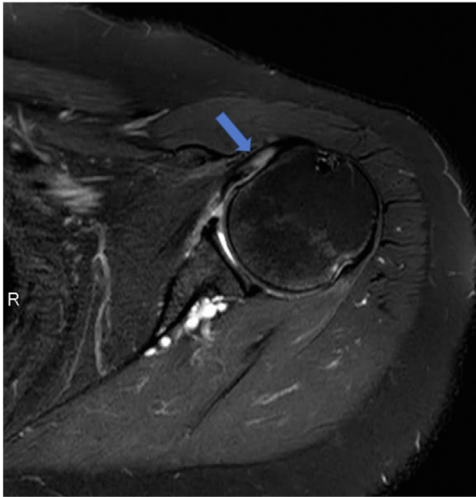


Fig 1. Coronal T2 weighted magnetic resonance image with fat saturation of left shoulder showing a high-graded partial articular-sided subscapularis tendon tear (arrow).

We propose an all-inside arthroscopic transtendon repair technique for a high-grade partial articular-sided subscapularis tendon tear without bursal-sided tendon overtension or bunching.

Preoperative Evaluation (With Video Illustration)

Magnetic resonance imaging of the shoulder is performed to identify subscapularis lesions and associated rotator cuff and capsulolabral tears.⁶ The high-graded partial articular-sided subscapularis tendon tear is shown in Fig 1 and Video 1.

Surgical Technique

Patient Positioning

After the administration of general anesthesia, the patient is placed in a beach-chair position. Then, after

the patient has been prepared and draped, anatomical bone landmarks are identified and labeled.

Step 1: Arthroscopic Examination

A 30° arthroscope is used to perform an arthroscopic examination of the glenohumeral joint. To begin, a conventional posterior portal is established 2 cm medial and inferior to the acromion's posterolateral corner. The posterior portal is used for a careful arthroscopic examination that confirmed the rotator cuff lesions, glenohumeral cartilage condition, and long head of biceps quality. The partial articular-sided subscapularis tendon tear is observed compatible with the magnetic resonance imaging findings (Fig 2A, Video 1).

Step 2: Portal Placement

The anterior portal is then created through the rotator interval with the outside-in technique (Fig 2B, Video 1). Then, the cannula is inserted through the anterior portal. The rotator interval and any adhesions, anterior and posterior to the subscapularis tendon, are released using an arthroscopic shaver and radiofrequency until the tendon is easily mobile from the anterior portal (Fig 2C, Video 1). The lesser tuberosity is prepared with a 5.0-mm motorized burr to enhance tendon-to-bone healing.

Step 3: Anchor Placement

After the subscapularis tendon has been released and the footprint preparation is done, at the same time, the shoulder is in a slight external rotation position, and insertion of the 4.5-mm tapered awl (Smith & Nephew, Andover, MA) is applied through the anterior cannula and used to create a pilot hole. The 5.5-mm double-loaded TWINFIX suture anchor (Smith & Nephew) is inserted into the pilot hole (Fig 3A, Video 1).

Step 4: Subscapularis Tendon Repair

The 90° curved Spectrum suture passer (CONMED, Utica, NY) is used to sew the articular-sided subscapularis tendon and pass a PDS suture (Ethicon,

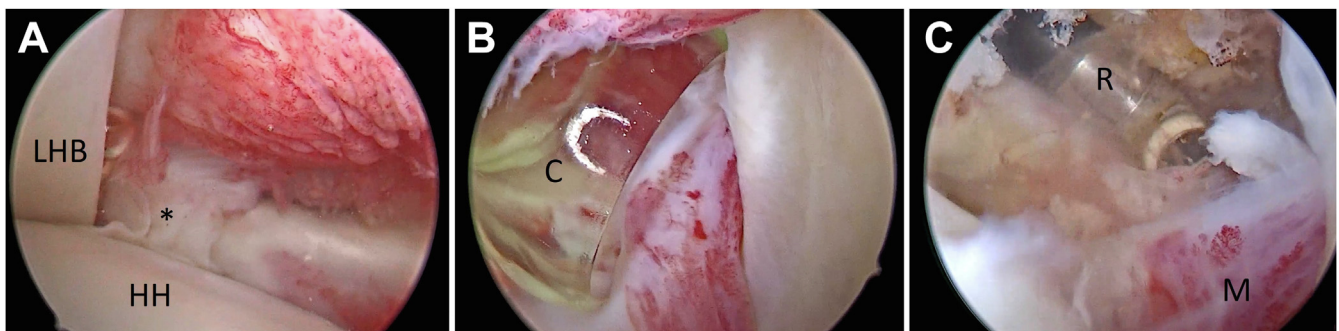


Fig 2. Left shoulder, beach-chair position, viewing from the posterior portal. (A) The partial articular-sided subscapularis tendon tear is observed. (B) The anterior cannula is inserted through the rotator interval. (C) The radiofrequency is used to release adhesion until the tendon is easily mobile. *Partial articular-sided subscapularis tendon tear. (C, anterior cannula; HH, humeral head LHB, long head of the biceps tendon; M, middle glenohumeral ligament; R, radiofrequency.)

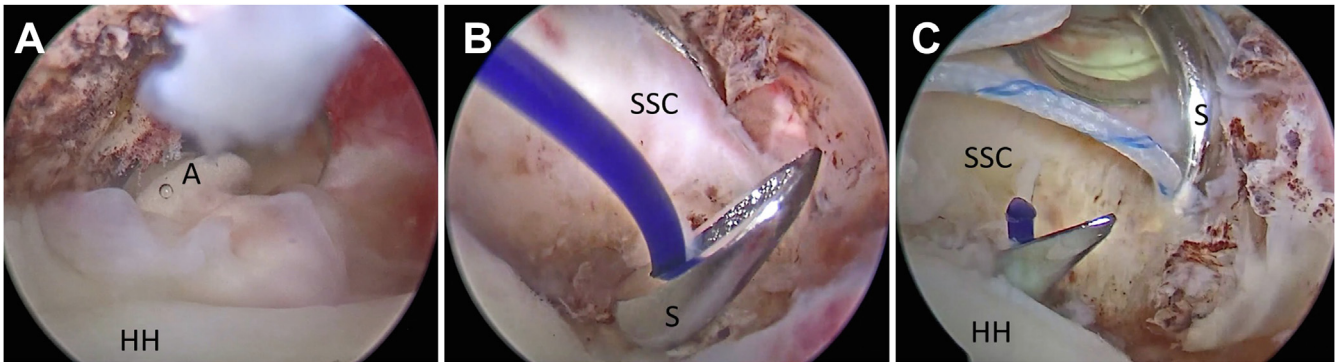


Fig 3. Left shoulder, beach-chair position, viewing from the posterior portal. (A) The 5.5-mm double-loaded TWINFIX suture anchor is inserted into the pilot hole while the shoulder is in a slight external rotation position. (B) The 90° curved Spectrum suture passer is used to sew the articular-sided subscapularis tendon and pass a PDS suture to shuttle the ULTRABRAID suture. (C) The process is repeated to shuttle another ULTRABRAID suture of the anchor through the tendon. (A, TWINFIX suture anchor; HH, humeral head; K, knot; S, Spectrum suture passer; SSC, subscapularis tendon.)

Somerville, NJ) to shuttle the ULTRABRAID suture (Smith & Nephew) of the anchor through the subscapularis tendon via the anterior portal (Fig 3B, Video 1). The process is repeated to shuttle another ULTRABRAID suture of the anchor through the tendon (Fig 3C, Video 1). The suture anchor's ULTRABRAID sutures are then secured using sliding knots (Fig 4 A and B, Video 1). Fig 4C shows the final repair construction.

Postoperative Care

The repaired shoulder is immobilized with a simple arm sling for 3 to 4 weeks following surgery. Active hand, wrist, and elbow exercises are allowed from the first day, and gradual shoulder mobilization begins under observation 15 days after surgery. Six weeks after surgery, actively assisted physiotherapy is suggested to gain full passive and active shoulder range of motion and perform everyday tasks without difficulty. Before 3 months, no strengthening or resistance exercises are permitted.

Discussion

Codman⁷ and Smith⁸ were the first to describe subscapularis tendon tears. In 1954, Hauser⁹ published the first case of surgical repair of the subscapularis tendon. Isolated and related subscapularis lesions affect 10% to 20% of the population.¹⁰ Several surgical techniques, including open and arthroscopy, are used.

A growing trend in arthroscopic repair, according to recent studies.¹¹ Smaller incisions with less soft-tissue trauma and the ability to visualize the articular side of the subscapularis tendon are advantages of an arthroscopic approach.³

In the case of a low-grade partial rotator cuff tendon tear, conservative treatment has a favorable result. If the tear is of a high grade, it will progress.¹² If the repair is chosen in a partial articular-sided subscapularis tendon tear, there is concern of overtension or bunching of the bursal-sided tendon, as in the PASTA transtendon repair, because the tendon fiber on the bursal side remains intact and connected to the lesser

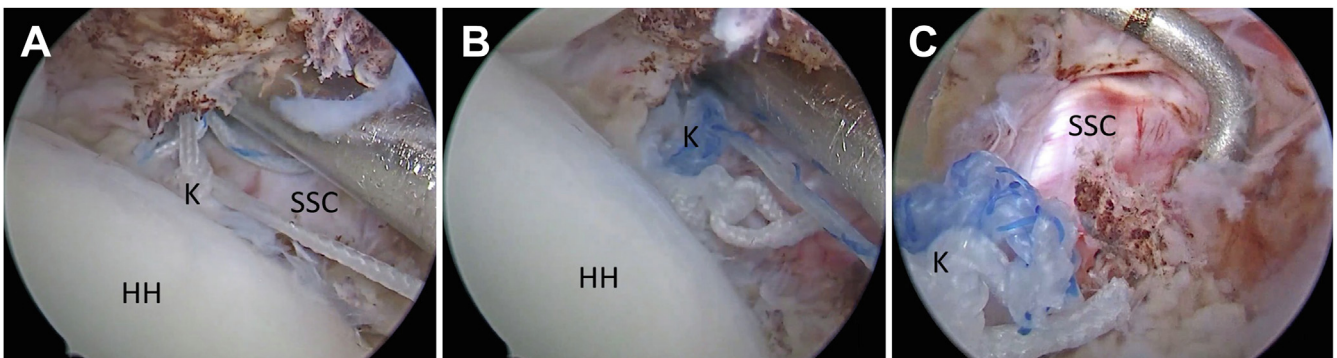


Fig 4. Left shoulder, beach-chair position, viewing from the posterior portal. (A) The suture anchor's ULTRABRAID suture is secured using sliding knot. (B) The process is repeated to secured another knot. (C) The final repair construction was shown. (HH, humeral head; K, knot; SSC, subscapularis tendon.)

Table 1. Advantages, Disadvantages, Pearls, and Pitfalls

Advantages	No subscapularis tendon bunching on the bursal side or overtension. Preservation of the intact bursal-sided tendon fiber. No Disruption to the blood supply of the intact tendon.
Disadvantages	High technical demand. Difficulty in suture management. There are the knots in the joint.
Pearls	To prevent fluid extravasation and swelling, repair the subscapularis first before the other rotator cuff tendons. Using the 90° curved SPECTRUM suture passer to sew only the articular-sided tendon fiber. Using anterior cannula for suture management.
Pitfalls	Tangling of sutures while using a single working portal. The sharp angle of the needle makes using the 90° curved Spectrum suture passer challenging to sew.

tuberosity.⁵ Because the authors are worried that this would affect shoulder kinematics, we propose a surgical technique to repair the partial articular-sided subscapularis tendon tear without overtension or bunching of the bursal-sided tendon in which we sew only the articular-sided tendon fiber.

Advantages of the presented technique include no subscapularis tendon bunching on the bursal side or overtension, preservation of the intact bursal-sided tendon fiber, and no disruption to the blood supply of the intact tendon. The technique presented here differs from the previous one in that it uses the 90° curved Spectrum suture passer to sew only the articular-sided tendon fiber.

Advantages/disadvantages and pearls/pitfalls of the procedure are further described in Table 1. In conclusion, this presented technique is a reproducible method and a safe surgical technique to repair the partial articular-sided subscapularis tendon tear.

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