Technical Note

# "Double Row Rip-Stop" Arthroscopic Repair Technique for Acute, Retracted Rotator Cuff Tears

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**Abstract:** Acute, retracted rotator cuff tendon tears are important to recognize and can present unique technical challenges to repair. Various arthroscopic techniques and suture configurations have been proposed for repair of acute tears with aims to maximize the repair footprint and optimize tendon fixation. The double row rip-stop configuration was designed and has been used for rotator cuff repair due to its potential advantages related to suture pullout, footprint reapproximation and load sharing. The purpose of this article is to present the author's arthroscopic technique for repair of acute, retracted rotator cuff tendon tears using a double-row, rip-stop suture configuration. The indications and authors' preferred arthroscopic technique for biceps tenodesis are also discussed.

## Introduction

Rotator cuff tendon pathology remains the most common condition treated by shoulder surgeons. Arthroscopic techniques have continued to advance, improving healing rates and clinical outcomes following repair. Many aspects of rotator cuff repair surgery have been studied extensively, improving surgeons' ability to treat these tears effectively. A wide variety of arthroscopic repair techniques have been evaluated and used in an effort to optimize the biomechanical performance of these repair constructs.[1] Traumatic rotator cuff tears are often treated surgically in an effort to allow for healing, restore shoulder function, and minimize progressive fatty infiltration.[2]

Double-row rip stop rotator cuff tear repair configurations have been proposed for index surgical intervention, in revision rotator cuff repair settings, and for cases in which poor tissue quality is present.[3,4] Advantages of this technique are provided through the combination of a double-row anchor configuration and a rip-stop suture construct.[5] Evidence supports lower retear rates when evaluating double versus single-row repair,[6] and biomechanical data show superiority for double- versus single-row constructs.[7,8] Additionally, rip-stop suture constructs have been shown to reduce suture pullout through soft tissue.[9,10] Clinical advantages of the double-row, rip-stop configuration versus single-row repair, however, has failed to show consistently superior results at short-term follow-up but has revealed improved structural healing rates.[11] A recent meta-analysis identified multiple sociodemographic, clinical evaluation, anatomic, and intraoperative factors for risks of retear following arthroscopic repair.[12] Because of the combined advantages of both double-row anchors and rip-stop suture configurations, the double-row rip-stop repair is an ideal configuration to combat the challenges of an acute, retracted rotator cuff tendon tear (Table 1). The following described technique is used by the authors as an effective and reproducible method to achieve a secure and anatomic repair of acute, retracted rotator cuff tendon tears.

## Surgical Technique

The surgical technique, which is described and illustrated (Video 1), is indicated for large rotator cuff tendon tears that demonstrate appropriate mobility to the anatomic rotator cuff tendon footprint. The patient is positioned in the beach chair position following

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induction of anesthesia, and the operative arm is prepared and draped in sterile fashion. A standard diagnostic arthroscopy is performed using a 30° arthroscope, as viewed from the posterior portal. Once all glenohumeral pathology is addressed, the subacromial space is then entered to view the rotator cuff detachment and assess tear reducibility. In the case shown, the entire supraspinatus is torn and retracted from its anatomic footprint. Partial infraspinatus tearing is also noted (Fig 1). Debridement of this rotator cuff tear aids in defining the extent of the detachment and reveals that the tear includes detachment of the anterior cable. Continued debridement allows for better exposure of the greater tuberosity and rotator cuff footprint (Fig 2). A trial reduction of the torn rotator cuff tendon to its anatomic footprint is accomplished using a soft tissue grasper inserted through an accessory lateral portal. Thorough evaluation to establish the most appropriate reduction vector for the detached tendon helps to ensure that a more anatomic repair is accomplished and that minimizes repair tension (Fig 3).

Because of the proximity of the intact biceps tendon to the repair footprint in this specific case and the importance of restoring the anterior cable of the supraspinatus, the authors elected to perform a tenodesis of the biceps tendon within the bicipital groove, using the authors' previously published "Triple-Fix" technique.[13] This Triple-Fix technique is also demonstrated in the technique video (Video 1 and Fig 4). Leaving the biceps intact until after the tenodesis is completed helps to preserve anatomic biceps length. Tenodesis at a location distal to the greater tuberosity allows for exposure of maximum available bony footprint and eliminates the possibility that the biceps tendon excursion, if left intact, could be inadvertently constrained or even that the biceps could become inadvertently entrapped within the rotator cuff repair.

**Table 1.** Advantages, Disadvantages, and Limitations of a Double Row, Rip-Stop Repair for Acute, Retracted Rotator Cuff Tears

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| **Advantages** |
| • Double-row effectively reestablishes the rotator cuff footprint and maximizes footprint compression. |
| • Rip-stop construct increases suture pullout strength from soft tissue. |
| • Multiple anchors share the load of the repair. |
| • Triple-loaded anchors offer increased number of sutures available to pass through tissue, while minimizing the number of required anchors. |
| **Disadvantages and Limitations** |
| • Inappropriately applying this technique to a tear without adequate mobility may overtension the tissue, leading to failure of the repair. |
| • Suture management and passing may prove difficult for surgeons not familiar with these methods or when some other type of antegrade suture passers are used. |
| • Biomechanical and outcomes data for this technique are limited. |

The double row rip-stop configuration requires a medial row and lateral row of anchors. While viewing from the lateral portal, a triple-loaded medial row anchor (Healicoil Regenesorb 5.5 mm; Smith and Nephew, Andover, MA) is percutaneously placed through an accessory portal located immediately adjacent to the anterior acromial edge. This medial row anchor is inserted into the greater tuberosity at the most medial aspect of the rotator cuff tendon footprint, adjacent to the articular cartilage of the superior humeral head. All 6 of the available suture limbs from this medial anchor are then retrieved through the torn tendon using a 60° retrograde suture passer in a horizontal mattress pattern (IDEAL suture grasper; Depuy Mitek, Raynham, MA). The suture placement should be spaced evenly across the torn tissue to facilitate full and anatomic reduction (Fig 5). Also, it is important to place these mattress sutures through the rotator cuff tendon ~10-14 mm medial to the lateral edge of the rotator cuff tendon, so that, when tied, they will anatomically reduce the rotator cuff tendon to the medial tuberosity without tendon overlateralization, as would occur if these mattress sutures were passed more medially through the detached tendon. A second triple-loaded anchor is then inserted into the lateral aspect of the greater tuberosity using the same percutaneous portal site location. These 3 lateral anchor sutures are all then retrieved in a simple pattern using the same suture passer. Importantly, these simple sutures are retrieved through the tendon medial to the medial row horizontal mattress sutures. Following the passage of all sutures through the torn rotator cuff tendon tissue, the sutures are then sequentially tied (Fig 6). The horizontal mattress sutures must be tied before the simple sutures, reducing the medial cuff tendon to its footprint. The lateral row simple sutures are subsequently tied completing the double row rip-stop construct (Fig 7). In this suture configuration, the repaired tendon is securely fixed to its anatomic footprint.

At the conclusion of the case, final arthroscopic photos are taken, a sterile dressing is applied, and an abduction shoulder brace is placed on the patient. Postoperatively, patients are protected in a sling for 4 to 6 weeks and begin formal physical therapy at 1 week postoperatively. Passive and active assisted range of motion exercises are begun and continued for 4 to 6 weeks followed at week 10 to 12 with a progressive strengthening program.

## Discussion

Acute, retracted rotator cuff tears present unique challenges to the arthroscopic shoulder surgeon. Goals of surgery include secure, anatomic fixation and restoration of the rotator cuff footprint in an effort to maximize the potential for healing and functional improvement. Although long-term outcome studies

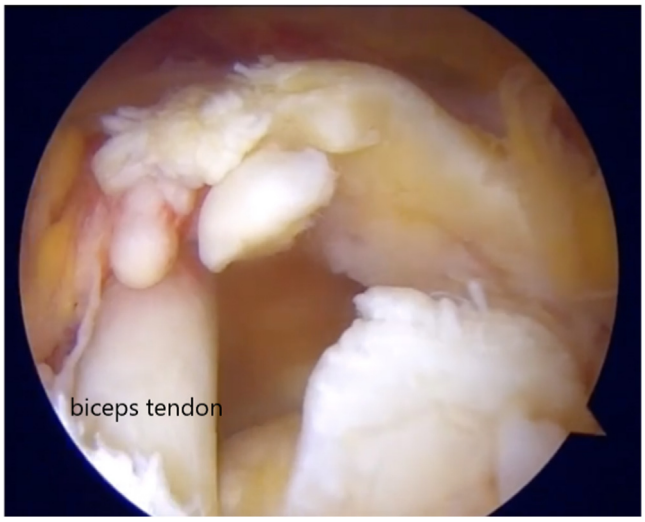


**Fig 1.** A traumatic, retracted tear involving the rotator cuff supraspinatus and infraspinatustendons in this left shoulder in the beach chair position, as viewed from the lateral portal. Note the intact biceps tendon, as labeled.

using this specific approach to repair for this type of tear are limited, this double-row rip stop technique configuration offers the combined advantages of both a double-row anchor construct and a "rip-stop" suture configuration. Additionally, triple loaded anchors reduce the number of required anchors, while maximizing the number of repair sutures per anchor. Despite the size and retraction of the demonstrated tear, the footprint of the torn tendons was anatomically restored, and the rotator cuff tissue securely fixed with only 2 anchors.

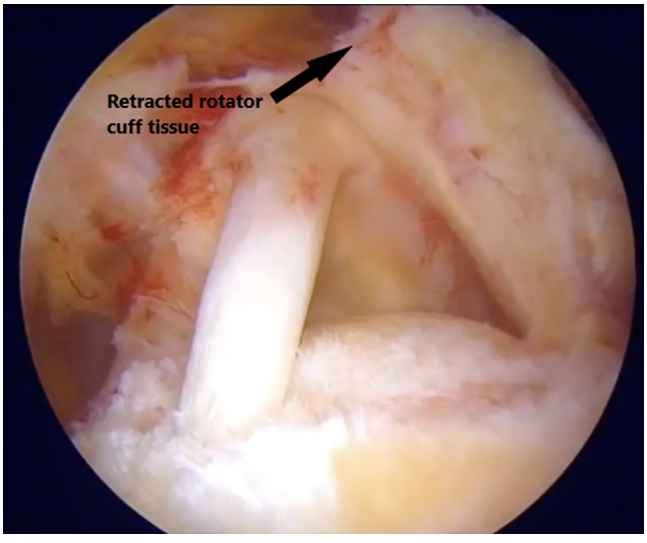


**Fig 2.** Viewing the left shoulder in the beach chair position from the lateral portal, the remaining torn tendon stump and interval tissue have been debrided to better visualize the extent of the tear. The retracted tear is indicated by an arrow.

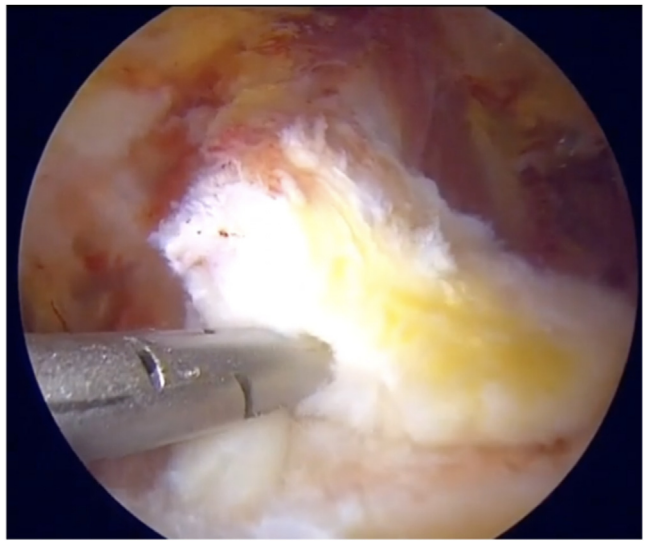

**Fig 3.** Viewing the left shoulder in the beach chair position from the lateral portal, a trial reduction of the tear is performed with a grasper introduced from an accessory anterolateral portal.

This technique is not recommended in rotator cuff tears with inadequate mobility that would accommodate full footprint coverage with low tension, as anatomic reapproximation to the lateral anatomic footprint would likely overtension the tissue and could lead to failure (Table 1). However, medialization of the greater tuberosity footprint achieved by removing a few millimeters of superior humeral head articular cartilage would increase the exposed, abraded bone and potentially allow for a double-row rip-stop construct to be

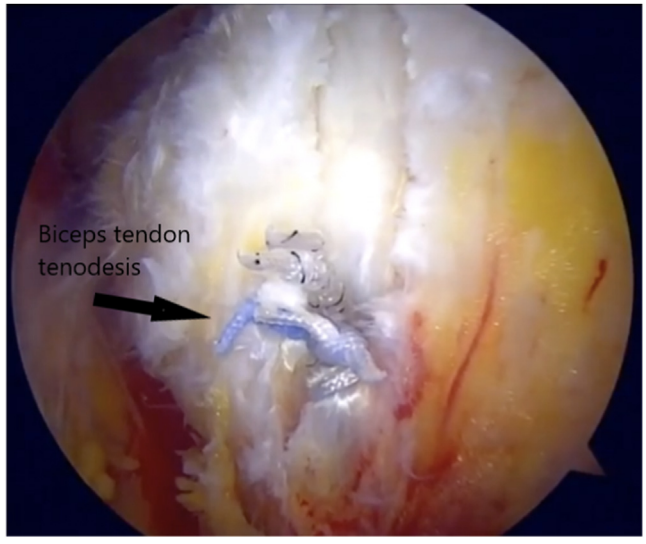


**Fig 4.** Viewing the left shoulder in the beach chair position from the lateral portal, a secure arthroscopic biceps tenodesis is performed using a suture anchor in the bicipital groove with a combination of luggage tag and simple sutures around and through the tendon, as indicated via arrow.

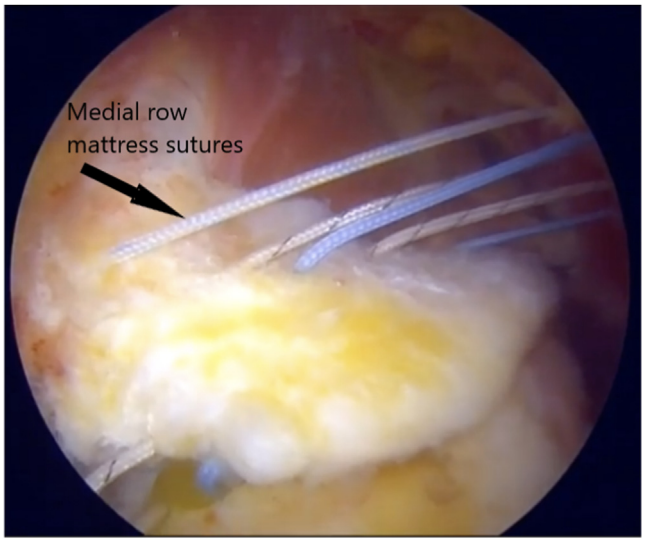


**Fig 5.** Viewing the left shoulder in the beach chair position from the lateral portal and after the medial row anchor has been placed, the sutures are passed through the tendon in evenly spaced horizontal mattresses (shown by arrow) using a retrograde suture passer.

used while still maintaining a lower tension repair (Table 1). The authors encourage readers that are not familiar with the double-row rip stop suture construct to consider using this technique for some repairs, as we have found the technique to allow for reproducible and secure rotator cuff tear fixation.

Pearls and pitfalls of this technique should be mentioned to help to ensure success of this procedure,

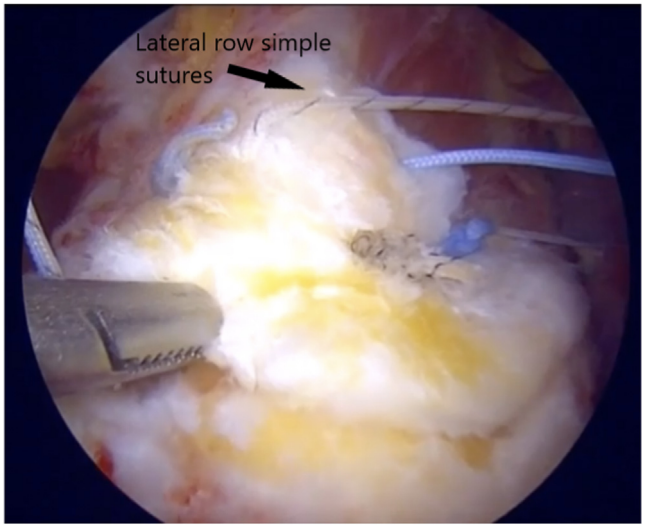


**Fig 6.** Viewing the left shoulder in the beach chair position from the lateral portal, the medial row horizontal mattress sutures have been tied with the grasper serving as a reduction aid through the accessory anterolateral portal. The medial footprint has been restored leaving the remaining lateral row simple sutures to be tied, as indicated via arrow.

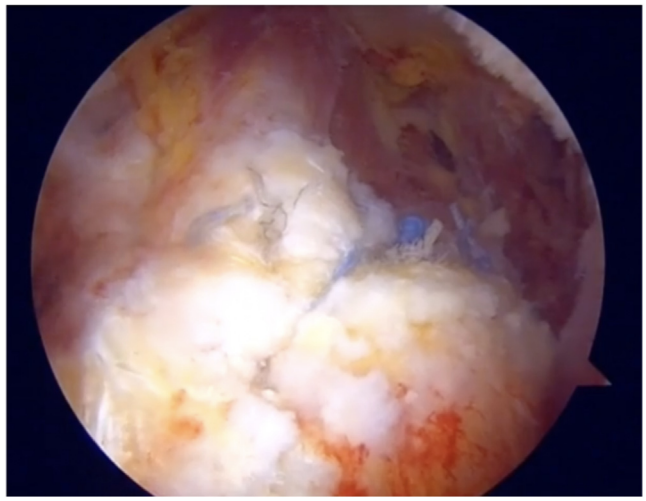

**Fig 7.** Viewing the left shoulder in the beach chair position from the lateral portal, the final construct is visualized after all sutures have been tied and cut. Restoration of the anatomic rotator cuff footprint and secure fixation is evident.

and these are outlined in Table 2. First, adequate visualization of the tear extent is essential. For this reason, the authors' preferred view is from the lateral portal, and an extensive debridement of the subacromial space, including thorough bursectomy is recommended. In the case example shown, the biceps tendon was removed from the repair area and securely tenodesed more distally within the bicipital groove. This allows for maximal visualization of and access to the greater tuberosity. A trial reduction of detached rotator

**Table 2.** Pearls and Pitfalls of a Double-Row Rip-Stop Repair for Acute, Retracted Rotator Cuff Tears

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| **Pearls** |
| Use the lateral portal for superior viewing of the tear. |
| Removal of the biceps tendon from the rotator cuff footprint maximizes footprint visualization and rotator cuff contact to prepared bone. |
| Ensure mobilization of the tendon and assessment of the reduction vector prior to anchor placement and suture passage, using a grasper from an accessory lateral portal. |
| Medial row anchor should be placed near the articular margin, re-establishing the medial extent of the tendon footprint. |
| Medial row sutures should be passed evenly, spanning the extent of the tear |
| Lateral row anchor should be placed at the great tuberosity in a location determined to appropriately re-establish reapproximation of the lateral extent of the rotator cuff tissue to the footprint. |
| Lateral row simple sutures should be placed medial to the medial row mattress sutures to complete the rip-stop construct. |
| Medial mattress sutures should be securely tied first, followed by the more medially placed simple sutures. |
| **Pitfalls** |
| Inadequate debridement of tissue and the biceps tendon may obstruct the optimal view and access to the greater tuberosity needed for repair. |
| Placement of anchors in improper locations may lead to poor re-establishment of the rotator cuff footprint and nonanatomic repair. |

cuff tissue is an essential step in planning most appropriate placement of the reapproximated tendon, suture anchors, and sutures to maximize footprint restoration, while also minimizing repair tension.

Although consensus has not been reached regarding the best arthroscopic approach to repairing acute, retracted rotator cuff tears, techniques that optimize soft tissue load distribution and repair strength while also reducing repair construct tension are desirable. Appropriate execution of the described technique results in secure, anatomic fixation of acute rotator cuff tears, maximizing the chance of healing and allowing the restoration of shoulder function.

## References


1. Bishop ME, MacLeod R, Tjoumakaris FP, et al. A biomechanical and clinical comparison of suture techniques in arthroscopic rotator cuff repair. *JBJS Rev* 2017;5:e3.
2. Spross C, Behrens G, Dietrich TJ, et al. Early arthroscopic repair of acute traumatic massive rotator cuff tears leads to reliable reversal of pseudoparesis. *Clin Radiogr Outcome Arthrosc* 2019;35:343-350.
3. Bills CC, Field ED, Field LD. "Double-row rip-stop" technique for arthroscopic rotator cuff repair. *Arthrosc Tech* 2017;6:e2053-e2059.
4. Ferguson WJ, Field LD. Revision rotator cuff repair: A comprehensive approach and stepwise technique. *Arthrosc Tech* 2021;10:e1737-e1742.
5. Denard PJ, Burkhart SS. A load-sharing rip-stop fixation construct for arthroscopic rotator cuff repair. *Arthroscopy Tech* 2012;1:e37-e42.
6. Weber S, Chahal J. Management of rotator cuff injuries. *J Am Acad Orthop Surg* 2020;28:e193-e201.
7. Kim DH, ElAttrache NS, Tibone JE, et al. Biomechanical comparison of a single-row versus double-row suture anchor technique for rotator cuff repair. *Am J Sports Med* 2006;34:407-414.
8. Smith CD, Alexander S, Hill AM, et al. A biomechanical comparison of single and double-row fixation in arthroscopic rotator cuff repair. *J Bone Joint Surg Am* 2006;88:2425-2431.
9. Lee BG, Cho NS, Rhee YG. Modified Mason-Allen suture bridge technique: A new suture bridge technique with improved tissue holding by the modified Mason-Allen-stitch. *Clin Orthop Surg* 2012;4:242-245.
10. Barber FA, Herbert MA, Schroeder FA, Aziz-Jacobo J, Mays MM, Rapley JH. Biomechanical advantages of triple-loaded suture anchors compared with double-row rotator cuff repairs. *Arthroscopy* 2010;26:316-323.
11. Noyes MP, Ladermann A, Denard PJ. Functional outcome and healing with a load-sharing rip-stop repair compared with a single-row repair for large and massive rotator cuff tears. *Arthroscopy* 2019;35:2295-2300.
12. Zhao J, Luo M, Pan J, et al. Risk factors affecting rotator cuff retear after arthroscopic repair: A meta-analysis and systematic review. *J Shoulder Elbow Surg* 2021;30:2660-2670.
13. Dale WW, McClatchy SG, Field LD. "Triple-fix" arthroscopic biceps tenodesis: Indications and technique. *Arthroscopy Tech* 2022;11:e717-e721.