Double Row Rotator Cuff Repair for Massive Reparable Rotator Cuff Tear

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Background: Massive rotator cuff tears, defined as those that involved 2 or more tendons or where the length of the greatest diameter is greater than 5 cm, present a unique surgical challenge as there can be significant scarring, retraction, and poor tissue quality. Furthermore, healing of these tears is less reliable. This video presents our technique for anatomic, double row repair of a massive reparable rotator cuff tear.

Indications: Indications for operative intervention include acute traumatic tears, as well as patients with pain and weakness who have failed to respond to conservative management, including physical therapy with confirmed large full thickness rotator cuff tear on advanced imaging. Of note, findings such as glenohumeral osteoarthritis, advanced muscle atrophy (Goutalier III/IV), superior migration of the humeral head >7 mm, and tears larger than 40 mm in length and width are concerning for irreparable tears, and may represent contraindications to surgical repair.

Technique Description: The patient is placed in the lateral decubitus position. After diagnostic arthroscopy is performed, a subacromial bursectomy is performed. A radiofrequency probe and arthroscopic shaver are used to perform releases in the subacromial space as well as superior to the glenoid. Preparation of the footprint of the humeral head is then performed to create a good healing surface. The rotator cuff is grasped to confirm tension free mobilization. The medial row anchors are then placed. Once placed, the sutures are incorporated into 2 lateral row anchors in sequential fashion. Subacromial decompression is then performed.

Results: Reduced pain and improved shoulder function are the goals of treatment, with sling immobilization lasting for roughly 6 weeks postoperatively prior to initiating strengthening and range of motion protocols.

Discussion/Conclusion: Arthroscopic double row repair produces an anatomic and stable reduction of reparable massive rotator cuff tears for patients that have failed conservative management.

Patient Consent Disclosure Statement: The author(s) attests that consent has been obtained from any patient(s) appearing in this publication. If the individual may be identifiable, the author(s) has included a statement of release or other written form of approval from the patient(s) with this submission for publication.

Keywords: rotator cuff tear; supraspinatus; double row; arthroscopy

VIDEO TRANSCRIPT

Hi, my name is Steve Marcaccio, and along with Dr. Rafael Buerba, Dr. Justin Arner, and Dr. James Bradley, I will be presenting a technique for double row rotator cuff repair for massive reparable rotator cuff tear. These are our disclosures.

Massive rotator cuff tears are defined as those in which the length of the greatest diameter of the tear measures more than 5 cm.[2,10] Others have also defined them as tears involving more than 2 tendons.[10] It is very important to consider the size of the tear, as size can have a direct effect on the clinical outcome and on tendon healing.[8]

97% of massive rotator cuff tears have a histopathologic pattern consistent with degenerative changes.[8] This includes reduced cellularity, decreased vascularity, increased disorganization, and lower collagen concentrations. This process of

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atrophy, fibrosis, and fatty infiltration that occurs over time can make surgical mobilization and repair challenging.[1,2,10]

Rotator cuff tears can alter shoulder mechanics. The shoulder can maintain a stable fulcrum of motion only when there are balanced moments in both the coronal and transverse planes. If there is a massive tear, then active motion is lost due to a lack of a stable fulcrum.[8] Also, the deltoid moment is no longer balanced, and this can lead to a loss of subacromial space height.

Typically, patients with rotator cuff tears present with an insidious onset of pain exacerbated by overhead activities, pain in the deltoid region, night pain, weakness, and loss of active range of motion (ROM) with intact passive ROM. During the workup of these patients, it is recommended to obtain radiographs and an magnetic resonance imaging (MRI).

Traditionally, rotator cuff tears should first undergo nonoperative management. This includes activity modification, non-steroidal anti-inflammatory drugs (NSAIDs), steroid injections, and physical therapy. However, it should be noted that we do not recommend steroid injections as this can damage the tendon tissue and increase the risk of tear propagation. Surgery is usually reserved for those with acute, traumatic tears, as well as those with more chronic injuries who have failed nonoperative management and continue to have pain and weakness.[10] However, new research has come out that may be challenging how we approach rotator cuff tears. In a well-designed 10-year follow-up study, it was shown that tendon repair is superior to physical therapy in the treatment of rotator cuff tears.[7]

The goal of a rotator cuff repair is to obtain an anatomical tension free repair of the tendon to the footprint. Before proceeding with surgery, reparable tears need to be distinguished from those tears that cannot be repaired. Patients with tears that are not reparable, tend to have severe weakness, superior migration of the humeral head, muscle atrophy and fatty infiltration, glenohumeral arthritis, and tears that measure more than 40 mm in length and width.[8] However, the correct biological host is paramount, as we typically recommend surgical repair of acute traumatic massive rotator cuff tears. Furthermore, additional biological contraindications, such as smoking and uncontrolled diabetes, need to be identified as these can severely impact patient outcomes in negative fashion.

For this video, we will discuss the following case. This is a 61-year-old female who presented with gradual onset of left shoulder pain for several months. She was not progressing well with physical therapy. Corticosteroid injections have not provided her with any relief. She also has pain that wakes her up at night. Her past medical history and past surgical history are not contributory to this case. On physical examination, she has active abduction of 120°, forward flexion to 140°, external rotation to 60°, and internal rotation to L5, with near full passive ROM. Her strength is 5-/5 in abduction, and 5/5 in external rotation, internal rotation, and subscapularis testing. She has a positive Jobe's, a negative O'Brien's test, a positive Hawkins test, and positive Neers test.

Radiographs of the left shoulder show a slightly decreased acromiohumeral interval, and a small subacromial spur. There is no evidence of glenohumeral osteoarthritis. MRI of the left shoulder demonstrates a full thickness tear of the supraspinatus and infraspinatus tendons with approximately 3 cm of retraction. These tears are shown by the yellow arrows. There is some fraying to the subscapularis without discrete tear. There is slight biceps tendinopathy.

The patient is placed in the lateral decubitus position with 10 pounds of traction. The glenohumeral joint is insufflated with normal saline prior to prepping and draping. The arm is then prepped and draped in the standard sterile fashion.

After performing a diagnostic arthroscopy, a subacromial bursectomy is performed using the arthroscopic shaver. We prefer using the 70° scope for the entire procedure for improved visualization with our portal placement, but the use of a 30° scope with an accessory posterolateral viewing portal can also be utilized. A general debridement is performed with the arthroscopic shaver for improved visualization. We make sure to debride the undersurface of the rotator cuff at the glenoid rim to aide in rotator cuff mobilization. To further mobilize the cuff, an arthroscopic elevator is used in the undersurface of the cuff above the glenoid. While surgical release of the rotator cuff both on its articular surface and within the subacromial space is highly recommended to increase tissue excursion, great care is taken not to go more than 2.5 cm medial to the glenoid rim to avoid injury to the suprascapular nerve. Furthermore, if the tendon is not able to be mobilized to be adequately be reduced to its greater tuberosity footprint, other augmentation options can be considered, such as dermal allograft augmentation or use of the biceps tendon (if available) in the form of anterior cable reconstruction, among other options. For the purposes of this video, we will focus on complete repair of the native tendon after adequate mobilization.

After this, the supraspinatus footprint is prepared with a curette to create a bleeding bony surface to promote healing of the tendon repair to the bone. This is supplemented with the use of an arthroscopic motorized rasp.

The soft tissues are then cleared off the lateral aspect of the humerus using an arthroscopic burner in order to make room for the lateral row anchors.

The cuff is grasped to test its mobility. In this case, the cuff reduced easily onto its footprint, and no further releases were needed. In order to control the cuff and provide traction to it, a looped suture is passed through the cuff and out the lateral cannula. A snap is placed on the suture outside the patient's body.

Through a percutaneous portal, the anterior of the medial row is drilled first. We prefer drilling over using a punch or an awl because there is a greater risk of humeral head fracture with these methods. After drilling, the drill hole is tapped. The tap is then carefully removed. Then a double loaded 4.75 mm anchor is screwed into place percutaneously.

In a similar fashion, using a spinal needle, a percutaneous portal is established, and a posterior medial row anchor is first drilled, tapped, and then screwed into place.

Of note, these anchors come double loaded with suture tape as well as fiberwire suture. The fiberwire sutures

were removed as they were not needed in this repair. The anterior medial row anchor tapes are then retrieved. Using the suture passing device, the most anterior tape is passed as anteriorly as possible into the cuff. Then, in a horizontal mattress fashion, the second tape is passed about 1 cm posterior to the first tape. The traction suture is used to assist in the passing of the sutures by bringing the cuff closer to the suture passing device. The sutures are then retrieved through the anterolateral portal for suture management.

The more anterior tape of the posteromedial row suture tapes is then retrieved through the lateral cannula. It is then passed through the rotator cuff with the suture passing device a few mm posterior to the previously placed anterior anchor tapes. It is again retrieved through the anterolateral portal for suture management. The posterior limb suture tape is retrieved and then passed in a horizontal mattress fashion to its anterior limb in the posterior part of the tear. The traction stitch is then released and removed from the cuff. A provisional reduction is attempted, but it is noted that the cuff would have dog ears anteriorly or posteriorly with the current configuration. To avoid this, a looped suture is passed with a suture passing device in front of the anterior anchor suture tapes. Although not shown in the video, a second looped suture was also passed in the posterior cuff.

In preparation for placement of the anterior lateral row anchor, the looped suture, the anterior limb of the anterior anchor, and the anterior limb of the posterior anchor are then retrieved through the lateral cannula. The sutures are then placed in a 5.5-mm anchor. We use larger anchors in the lateral row in order to have increased purchase in the bone as it is generally softer in this area of the humerus. The awl is then used to punch a hole in the lateral humerus. The sutures are then tensioned individually and reduction of the cuff onto its footprint is observed. The 5.5-mm anchor is then screwed into place and the sutures are cut. The process is then repeated for the posterior lateral row anchor. The remaining sutures are retrieved and placed through a 5.5-mm anchor outside the body. A provisional reduction of the cuff is attempted. Once the appropriate location of the anchor has been identified, the awl is used. The sutures are then tensioned individually until the cuff is reduced anatomically. The anchor is then screwed into place and once the anchor is well seated, the sutures are cut.

Given the patient's impingement symptoms and hypertrophic coracoacromial ligament (CA) ligament, a CA ligament contouring is performed using the arthroscopic burner.

This is the final product after double row repair of a massive rotator cuff tear. The cuff has been anatomically reduced with a tension-free construct, and it can be seen that the shoulder has an excellent ROM without compromising the repair.

This slide highlights some technical pearls to consider from our senior author, including a thorough preoperative evaluation and workup of the tear to determine with one's best ability, whether a tear is reparable or irreparable, careful debridement and mobilization of the torn tendon in order to maximize excursion and minimize danger to the suprascapular nerve, optimizing medial row anchor placement, including the use of tools such as a percutaneous probe as needed to adequately visualize the articular margin, using 5.5 mm anchors in the lateral row to optimize fixation in poor quality bone, and the use of independent sutures as needed for management of dog ears.

The postop protocol consists of use of a sling for 6 weeks. A self-directed passive ROM protocol begins at 24 hours. The patient then starts physical therapy at 4 weeks, in which isometrics and active ROM are started. At 6 to 8 weeks, the sling is removed, and the strengthening begins. At 2 to 3 months, eccentric exercises and gentle plyometrics are started. At 4 months, progressive plyometrics and a total body conditioning program are started. At 5 months, the patient will begin work in sports specific activities. At 6 months, clearance for sports or work depends on patient specific shoulder demands.

There has been an increasing amount of literature regarding how to best manage large to massive repairable rotator cuff tears, particularly regarding single row versus double row repairs. In our practice, we prefer double row repairs. Studies looking at biomechanical outcomes comparing double row versus single row repairs have shown that double row repairs have increased load to failure, improved contact areas and pressures, and decreased gap formations.[3-5] Double row repairs also consistently reproduce the original supraspinatus footprint approximately 100% of the time versus only 46% of the time for single row repairs.[3-5]

Regarding clinical outcomes for single row versus double row repairs, studies have shown that patients who undergo double row repairs for tears measuring more than 3 cm have improved constant, University of California, Los Angeles (UCLA), and American Shoulder and Elbow Surgeons (ASES) scores, as well as improved strength and decreased retear rates compared to patients who undergo single row repairs, as shown by this 2014 study.[6,9] Of note, when it comes to smaller tears, several studies have found no clinical improvement in outcomes scores for double row versus single row repairs despite single row repairs having higher rates of image-proven retears.[6]

Thank you for your attention, and we hope that you find this technique video to be useful.

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