An Arthroscopic-Plus-Open Method of Repair for Combined Tears of the Subscapularis, Supraspinatus, and Infraspinatus Tendons

David Capiola, MD, and Glen Ross, MD

**Abstract**

Tears involving the subscapularis and posterosuperior rotator cuff comprise a distinct clinical entity. An aggressive treatment involving operative repair has demonstrated superior results compared with delayed intervention, yet there is no consensus as to the optimal method of repair. Various methods are evolving, but they are not without their pitfalls. Methods of fixation, patient positioning, and biceps management are emerging as points of contention.

In this technical note, we describe an arthroscopic-plus-open approach in which arthroscopic repair of the posterosuperior rotator cuff is followed by an open subscapularis repair. Advantages of this method include ability to address concomitant pathology, relative ease of repair, and creation of a strong, reliable construct. The interval-splitting approach affords minimal additional morbidity and does not preclude use of allograft or biological augmentation for salvage procedures. Overall, this method is an effective, efficient technique that yields reproducible, reliable repair of these combined rotator cuff tears.

Subscapularis tears occur less often than posterior rotator cuff tears but have received more attention recently. The incidence of tears involving the subscapularis and supraspinatus tendons (anterosuperior rotator cuff tears) and the infraspinatus tendon—massive 3-tendon tears—has been reported to be 2% to 8%. This anterosuperior tear pattern represents a distinct classification with a unique mechanism, presentation, and outcomes. Accordingly, clinical and imaging techniques for detecting and classifying these injuries have evolved. An emphasis has been placed on surgical treatment options, as prompt repair (vs delayed intervention) has been shown to yield better outcomes. However, there is no consensus as to the ideal method for operative repair. There are controversies regarding open versus arthroscopic techniques, positioning, ways to address biceps pathology, and fixation. In this technical note, we describe the operative procedure (arthroscopic-plus-open approach) used to treat 11 patients with subscapularis and associated supraspinatus/infraspinatus tears.

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**Case Reports**

Eleven patients with combined subscapularis and supraspinatus tendon tears with or without infraspinatus tears were identified. The most common mechanism of injury was a fall, though no frank dislocations were reported. All 11 patients had shoulder pain and weakness, and 7 reported previous shoulder pain. Physical examination findings included positive lift-off, belly press, “bear-hug” tests and increased passive external rotation. Complete

Dr. Capiola is from Beth Israel Hospital and is Attending Orthopaedic Surgeon, New York Methodist Hospital, Brooklyn, New York.

Dr. Ross is from New England Baptist Hospital and is Attending Orthopaedic Surgeon, Northeastern University Team Physician, Boston, Massachusetts.

Address correspondence to: David Capiola, MD, 39 East 69th Street, New York, NY 10021 (e-mail, dcapiola@yahoo.com).

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Subscapularis tears were confirmed with magnetic resonance imaging, and no significant fatty infiltration of the muscles was present.

**Operative Technique**

After administration of general anesthesia and preoperative antibiotics, shoulder range of motion (ROM) is assessed, specifically with respect to stiffness and increased external rotation compatible with a complete subscapularis tear. The patient is positioned in the standard lateral decubitus position using the bean-bag stabilizer, incorporating an axillary roll and blankets to minimize compression on the brachial plexus and peroneal nerve. The arm is placed in 8 to 10 pounds of traction, and the shoulder is widely draped in the usual sterile fashion.

After all bony landmarks, portals, and axillary incision are marked, arthroscopy is initiated. A diagnostic glenohumeral arthroscopy is initially performed through the posterior portal, and special attention is given to the intra-articular portion of the subscapularis, the biceps and its anchor, and the supraspinatus and infraspinatus. Labral pathology is also addressed. An assessment can be made of the superior portion of the subscapularis; the extent of the tear, the degree of retraction, and tissue quality are noted. The status of the biceps is assessed, as the biceps is often medially subluxed from disruption of the medial sling/coracohumeral ligament complex. The biceps is then drawn into the joint using a probe, and a tenodesis or tenotomy is considered. If biceps pathology exists, a spinal needle is used to deliver a marking suture, and it is tenotomized at its attachment to the labrum at this point. The supraspinatus and infraspinatus undersurfaces are inspected and debrided from this position, if deemed necessary. The arthroscope is then removed from the glenohumeral joint and placed into the subacromial space, where a bursectomy is performed, and then the posterosuperior rotator cuff is assessed further. A subacromial decompression is performed, if necessary, with preservation of the coracoacromial arch, followed by arthroscopic suture anchor placement and repair of the posterosuperior rotator cuff using Mason-Allen configurations. The biceps is not incorporated into the construct at this time.

After repair of the supraspinatus and infraspinatus is complete, the shoulder is drained, and the open portion of the procedure is initiated. At this point, the arm is withdrawn from traction, the bean bag is deflated, and the patient is carefully rolled posteriorly into a partially supine, semi–beach-chair position. This is all accomplished while maintaining sterility; however, the shoulder is re-prepared with an isolation drape. The arm is placed on a sterile Mayo stand at the side.

An axillary incision is made starting just distal to the coracoid process and extending to the axillary crease. Dissection is carried out with full-thickness flaps to the depth of the deltopectoral interval, and the cephalic vein is mobilized and retracted laterally. The interval is developed, self-retaining retractors are placed, and the clavpectoral fascia is exposed. This is incised, and the retractors are repositioned with the conjoined tendon medial and with the deltoid and vein lateral, thus expos-

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Figure 2. Intraoperative view shows vertical anchor placement in footprint, passing of Mason-Allen sutures, and tension maintained with traction sutures. Biceps was previously tagged and released for later tenodesis.

Figure 3. Configuration after tensioning and securely tying subscapularis down to its footprint. Biceps is seen tagged laterally.
ing the subscapularis and bursal tissue, which is excised. Depending on the chronicity of the tear, the subscapularis may be freed from its surrounding tethering tissue by blunt dissection from the conjoint tendon, coracoid, capsule, and anterior border of the supraspinatus. The axillary nerve is palpated at its anterior border. At this point, traction sutures in the tendon edge may be placed to aid in mobilization to ensure that strong, viable tissue is incorporated into the repair. The coracoid process may be inspected and palpated, and the decision can be made as to whether a coracoplasty is warranted.

The subscapularis insertion at the lesser tuberosity is then identified lateral to the articular margin, débrided of its soft tissue, and lightly decorticated using a rongeur. Two or three 5.5-mm Bio-Corkscrew FT anchors with Fiberwire (Arthrex, Naples, Fla) are then inserted into the prepared bed. With free needles, sutures are placed incorporating a modified Mason-Allen configuration through the viable tendinous portion of the subscapularis tendon with the arm in 20° of external rotation. Degree of external rotation and the “bounce” sign should be assessed, documenting strength and tension of the repair. At this point, the previously tenotomized and tagged biceps can be tenodesed into the footprint/bicipital groove with sutures from the anchors, augmented with additional Vicryl sutures as needed. The wound is copiously irrigated and is closed with interval, subcutaneous, subcuticular, and portal sutures. Sterile dressings are applied, and the patient is placed in a sling and swathe. Postoperative rehabilitation involves passive ROM and pendulum exercises, avoiding external rotation of more than 30° for 4 to 6 weeks, active-assisted ROM and gentle stretching from weeks 6 to 12, and strengthening after week 12.

**DISCUSSION**

Operative repair of combined subscapularis and supraspinatus/infraspinatus tears has been demonstrated to yield superior results in comparison with conservative management, particularly in the acute setting. Authors have described a variety of surgical techniques. Kreuz and colleagues described making 2 separate incisions—an anterior approach for the subscapularis and a deltoid-splitting superior incision for the supraspinatus. Outcomes were worse for combined tears necessitating second incisions than for isolated subscapularis tears, though this could have been partially related to injury pattern. Warner and colleagues used an anterosuperior approach, extending the deltopectoral skin incision and splitting the deltoid—required to gain access to the posterior tendons in 74% of the patients—and bone tunnels were used. Travis and colleagues described a deltopectoral approach with release of the conjoined tendon from the coracoid process for exposure and visualization. Burkhart and Brady elegantly described an all-arthroscopic technique using a 3-sided release, coracoplasty, identification of the “comma sign” or medial bicipital sling remnant, and suture anchor repair. Bennett described a similar approach comparing suture anchor (Corkscrew, Arthrex, Naples, Fla) with polyglycolic acid tac repairs (Suretac, Acufex, Mansfield, Mass), emphasizing reconstruction of the medial bicipital sheath.

Although there are several advantages and disadvantages to these procedures, each surgeon must develop a technique that is reliable, feasible, and reproducible in his or her own hands. A recently described all-arthroscopic approach requires a specialized setup with variable arthroscopes (30°, 70°), a dedicated second assistant to provide a “posterior lever push” for visualization, accessory portals, and a highly skilled arthroscopist. For the arthroscopist who performs the procedure only a few times a year, this approach may not prove to be the ideal option.

The procedure detailed in this technical note has several proposed benefits. Perhaps the most significant is the ease with which a strong, reproducible repair can be performed. Although this approach requires a skin incision, it adds only minimal morbidity, as it is a small axillary incision with favorable cosmesis, and it is an interval-splitting approach (deltoperatoral) that does not violate the muscle–tendon unit. This approach differs from the method of open or even mini-open

![Figure 4. Intraoperative photograph (A) and diagram (B) show supraspinatus and subscapularis repair with anchors and Mason-Allen suture configuration incorporating biceps. Illustration copyright 2009 by D. Capiola.](image)
posterosuperior rotator cuff repair, in which detachment or splitting of the deltoid is a significant concern. In addition, it still affords the benefits of arthroscopic diagnosis and assessment, with the ability to address concomitant issues. The frequently involved biceps is easily accessible with this approach and can readily be incorporated into the repair. The strength of the subscapularis repair may be easily assessed (bounce sign) and tailored by controlling the degree of external rotation and tension during the repair. This approach may be performed effectively with the patient in either the lateral decubitus or beach-chair position, and such salvage options as pectoralis major transfers, Z-plasty, and biological tissue augmentation can also be performed in this position if deemed necessary.

A problem that may arise with this technique is arthroscopy fluid extravasation, which occurs when transitioning to the open portion of the case. In our experience, this has not proved to be a limiting factor, as long as judicious suction is used at the conclusion of the arthroscopic portion and the outset of the open procedure. Moving the patient from the lateral decubitus position to the semi–beach-chair position requires planning but has proved to be simple with use of a bean-bag apparatus. Overall, this arthroscopic-plus-open method is an efficient, straightforward approach that affords a strong, reliable repair in tears of the subscapularis and supraspinatus/infraspinatus tendons.

**References**


**Authors’ Disclosure Statement**

Dr. Capiola reports no actual or potential conflict of interest in relation to this article. Dr. Ross wishes to note that he is part of the teaching faculty for Arthrex.

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