

An Arthroscopic-Plus-Open Method of Repair for Combined Tears of the Subscapularis, Supraspinatus, and Infrapinatus 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 infrapinatus tendon—massive 3-tendon tears—has been reported to be 2% to 8%.¹ This anterosuperior tear pattern represents a distinct classification with a unique mechanism, presentation, and outcomes.² 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.^{2,4} 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/infrapinatus tears.

“The frequently involved biceps is easily accessible with this approach and can readily be incorporated into the repair.”

CASE REPORTS

Eleven patients with combined subscapularis and supraspinatus tendon tears with or without infrapinatus 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” tests⁵ and increased passive external rotation. Complete

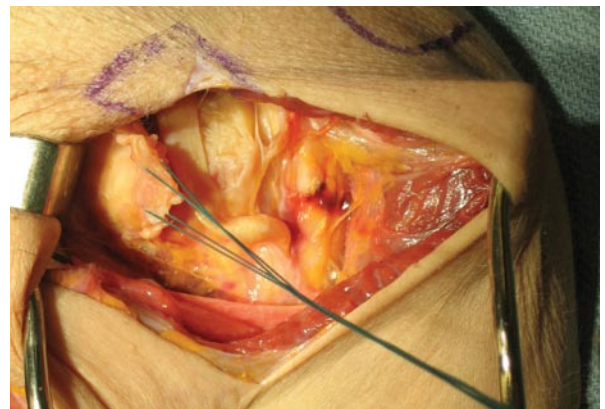


Figure 1. Traction sutures placed to aid in mobilization. Biceps is seen subluxed from its groove.

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).

Am J Orthop. 2009;38(12):602-605. Copyright, Quadrant HealthCom Inc. 2009. All rights reserved.

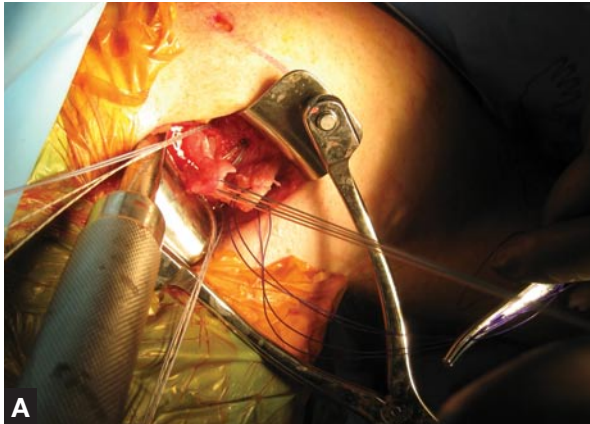


Figure 2. Intraoperative view shows vertical anchor placement in footprint, passing of Mason-Allen sutures, and tension maintained with traction sutures. Biceps was previously tagged and released for later tenodesis.

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

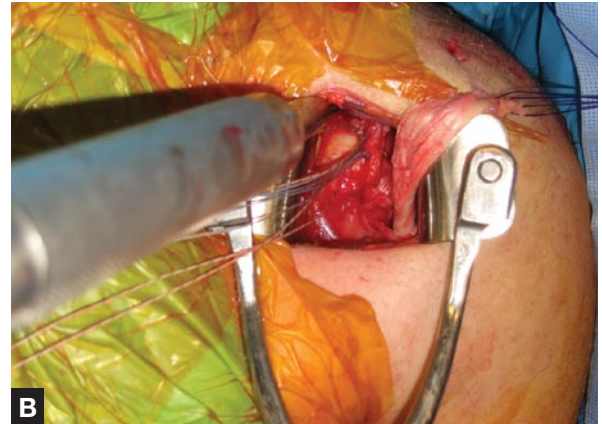


Figure 3. Configuration after tensioning and securely tying subscapularis down to its footprint. Biceps is seen tagged laterally.

it is tenotomized at its attachment to the labrum at this point. The supraspinatus and infraspinatus undersurfaces are inspected and débrided 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

“This approach may be performed effectively with the patient in either the lateral decubitus or beach-chair position.”

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

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 clavicle fascia is exposed. This is incised, and the retractors are repositioned with the conjoint tendon medial and with the deltoid and vein lateral, thus expos-

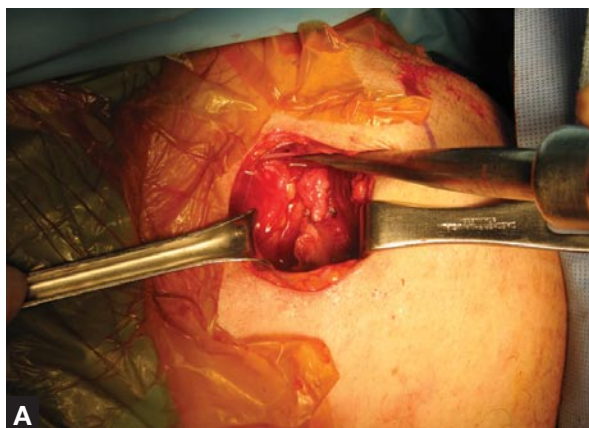


Figure 4. Intraoperative photograph (A) and diagram (B) show supraspinatus and subscapularis repair with anchors and Mason-Allen suture configuration incorporating biceps. Illustration copyright 2009 by D. Capiola.

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.^{3,6} Authors have described a variety of surgical techniques. Kreuz and col-

leagues⁴ 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 partly related to injury pattern. Warner and colleagues² 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 colleagues⁷ described a deltopectoral approach with release of the conjoint tendon from the coracoid process for exposure and visualization. Burkhart and Brady⁸ 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. Bennett⁹ 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.⁸ 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 (deltopectoral) that does not violate the muscle–tendon unit. This approach differs from the method of open or even mini-open

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.

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.

REFERENCES

1. Li XX, Schweitzer ME, Bifano JA, Lerman J, Manton GL, El-Noueam KI. MR evaluation of subscapularis tears. *J Comput Assist Tomogr*. 1999;23(5):713-717.
2. Warner JJ, Higgins L, Parsons IM 4th, Dowdy P. Diagnosis and treatment of anterosuperior rotator cuff tears. *J Shoulder Elbow Surg*. 2001;10(1):37-46.
3. Lyons RP, Green A. Subscapularis tendon tears. *J Am Acad Orthop Surg*. 2005;13(5):353-363.
4. Kreuz PC, Reminger A, Erggelet C, Hinterwimmer S, Niemeyer P, Gächter A. Isolated and combined tears of the subscapularis tendon. *Am J Sports Med*. 2005;33(12):1831-1837.
5. Barth JR, Burkhart SS, De Beer JF. The bear-hug test: a new and sensitive test for diagnosing a subscapularis tear. *Arthroscopy*. 2006;22(10):1076-1084.
6. Flury MP, John M, Goldhahn J, Schwyzer HK, Simmen BR. Rupture of the subscapularis tendon (isolated or in combination with supraspinatus tear): when is a repair indicated? *J Shoulder Elbow Surg*. 2006;15(6):659-664.
7. Travis RD, Burkhead WZ Jr, Doane R. Technique for repair of the subscapularis tendon. *Orthop Clin North Am*. 2001;32(3):495-500.
8. Burkhart SS, Brady PC. Arthroscopic subscapularis repair: surgical tips and pearls A to Z. *Arthroscopy*. 2006;22(9):1014-1027.
9. Bennett WF. Arthroscopic repair of anterosuperior (supraspinatus/subscapularis) rotator cuff tears: a prospective cohort with 2- to 4-year follow up. Classification of biceps subluxation/instability. *Arthroscopy*. 2003;19(1):21-33.

2009 Resident Writer's Award

The 2009 Resident Writer's Award competition is sponsored through a restricted grant provided by DePuy. Orthopedic residents are invited to submit original studies, reviews, or case studies for publication. Papers published in 2009 will be judged by *The American Journal of Orthopedics* Editorial Board. Honoraria will be presented to the winners at the 2010 AAOS annual meeting.

\$1,500 for the First-Place Award

\$1,000 for the Second-Place Award

\$500 for the Third-Place Award

To qualify for consideration, papers must have the resident as the first-listed author and must be accepted through the journal's standard blinded-review process.

Papers submitted in 2009 but not published until 2010 will automatically qualify for the 2010 competition.

Manuscripts should be prepared according to our Information for Authors and submitted via our online submission system, Editorial Manager®, at www.editorialmanager.com/AmJOrthop.

Through a restricted grant provided by

