

12 Arthroscopic Rotator Interval Closure

Andreas H. Gomoll

Department of Orthopedic Surgery, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts, U.S.A.

Brian J. Cole

Departments of Orthopedics and Anatomy and Cell Biology and Division of Shoulder and Elbow Surgery, Department of Orthopedic Surgery, Rush University Medical Center, Rush Medical College, Chicago, Illinois, U.S.A.

INTRODUCTION

The rotator interval has been identified as an important anatomic structure contributing to shoulder stability. It is defined as the articular capsule bordered by the superior margin of the subscapularis inferiorly, the leading edge of the supraspinatus superiorly, the base of the coracoid medially, and the long head of the biceps tendon laterally (Fig. 1). It varies in size (1), and its incompetency results in increased glenohumeral translation in all planes (2). Glenohumeral instability is rarely the result of an isolated deficiency of the rotator interval and, therefore, its closure is usually only an adjunct to standard arthroscopic instability repair. While indications remain for rotator interval closure, there is emerging conservatism amongst surgeons specializing in shoulder instability. As such, it should be performed at the end of the procedure, when inferior or posteroinferior instability persists in spite of adequate labral repair and capsular plication (3). Overtightening of the rotator interval is associated with significant loss of external rotation. Various techniques for arthroscopic rotator interval closure have been reported (4–6), which will be presented in this chapter.

INDICATIONS FOR SURGERY

The main indication for rotator interval closure is as an adjunct in patients who present with symptomatic shoulder instability (chronic traumatic antero-inferior, bi-directional, posterior, or multi-directional instability) with pain and functional impairment refractory to nonoperative treatment and, thus, who are candidates for surgical management.

Patients frequently report a traumatic shoulder dislocation as the initial event, followed by persistent subluxation or frank dislocation. However, instability can also present with vague symptoms, such as pain, fatigue, or popping with repetitive physical activity. Typically, patients with bi-directional or multi-directional instability may complain of pain in various positions of glenohumeral rotation and, possibly, “dead-arm” type symptoms during provocative activities. Physical examination findings depend upon the instability pattern being addressed. Traumatic antero-inferior instability reveals glenohumeral instability with varying degrees of humeral translation on the load-shift test, positive apprehension, and sulcus signs. Patients with bi-directional or multi-directional instability may have pain with provocative testing, but typically lack signs of apprehension. They too will often have a sulcus sign. A sulcus sign that does not decrease with external rotation at the side in association with any instability pattern signifies a rotator interval lesion with functional incompetence and should be surgically addressed in conjunction with labral repair and capsular plication as necessary.

Unfortunately, there are currently no imaging modalities that have good sensitivity and specificity to detect rotator interval lesions.

CONTRAINDICATIONS

Contraindications include inability to tolerate surgery, active infection, or restricted motion. A relative contraindication is concurrent rotator cuff repair, due to concerns of a higher incidence of postoperative stiffness.

TECHNIQUE

Anesthesia and Positioning

The procedure can be performed under general or regional anesthesia, or a combination thereof. After appropriate antibiotic prophylaxis and induction of anesthesia, the patient is placed in the beach-chair position or lateral decubitus depending on surgeon preference and instability pattern.

Examination Under Anesthesia

After positioning, and before the extremity is prepped and draped, the surgeon should examine shoulder motion and stability in all planes. The major direction of instability should be determined, and the amount of inferior translation (sulcus sign) should be assessed both in neutral and external rotation. A persistent sulcus sign with the shoulder adducted and externally rotated suggests rotator interval incompetency that may contribute to pathologic glenohumeral translation and to symptomatic instability.

Portal Placement and Arthroscopic Examination

A diagnostic arthroscopy of the glenohumeral joint is performed through standard anterior and posterior portals. Findings such as redundancy of the capsule in the rotator interval and tearing or fraying of the superior glenohumeral ligament, biceps tendon, or superior border of the subscapularis tendon are common in rotator interval incompetency (3). Associated pathology such as a superior labrum anterior to posterior (SLAP) tear should be repaired first; subsequently, glenohumeral instability should be addressed by labral repair and capsular plication as needed. If repeat examination demonstrates persistent inferior or posteroinferior instability, rotator interval closure can provide additional stability.

Rotator Interval Closure

The capsule within the rotator interval is gently abraded with an arthroscopic rasp or a synovial shaver (without suction) to encourage healing. A spinal needle is then placed percutaneously, or through an existing anteroinferior portal, penetrating the middle glenohumeral ligament and capsule just superior to the subscapularis tendon, and a monofilament suture is threaded into the glenohumeral joint (Fig. 2). If this tissue is inadequate for repair, the superior edge of the subscapularis can be incorporated in this repair, although we have rarely found this necessary. Subsequently, a tissue penetrator is placed through the anterosuperior portal to pierce the superior glenohumeral ligament and capsule just anterior to the leading edge of the supraspinatus tendon (Fig. 3). It is important to direct the penetrator anterior to the long head of the biceps to avoid incorporating the tendon into the repair. The monofilament suture is retrieved with the tissue penetrator, withdrawn through the anterosuperior portal, and used to shuttle a braided nonabsorbable suture through the capsular tissue (Fig. 4).

A knot pusher is threaded over the inferior limb of the suture and passed through the anteroinferior portal to deliver the suture out the anterosuperior portal (Fig. 5). If the inferior limb was placed percutaneously, without establishment of a formal anteroinferior portal, a small stab incision facilitates passage of the knot pusher. It is important to ensure that the knot pusher is passed in the subacromial space just anterior to the capsule and underneath the deltoid muscle. This is accomplished by a combination of external palpation of the deltoid muscle and intra-articular visualization of the knot pusher tenting the anterior capsule. Both suture limbs are now protruding through the anterosuperior portal (Fig. 6) and can be tied by an appropriate sliding knot. Under direct arthroscopic visualization, tension is

applied to the suture to draw the superior glenohumeral ligament and the inferior rotator interval tissue together, thus demonstrating the degree of rotator interval closure (Fig. 7). To avoid loss of external rotation, the shoulder is placed in adduction and 30° to 40° of external rotation, before knot tying. If needed, additional sutures can be placed, progressing from lateral to medial. Most commonly, no more than two sutures are placed in the lateral aspect of the interval.

Alternatively, the knot can be tied under direct visualization in the subacromial space. In this technique, the arthroscope and anterosuperior cannula are placed in the subacromial space after initial suture passage. The inferior limb of the suture is then retrieved through the anterosuperior portal and tied under direct visualization.

After suture placement, the shoulder should be gently ranged to ensure that rotator interval closure did not result in excessive limitation of external rotation. Finally, the portals are closed with simple sutures, a sterile dressing is applied, and the arm is placed in a shoulder immobilizer.

PEARLS AND PITFALLS

If the inferior limb of the suture is placed percutaneously, without the use of a formal antero-inferior portal, a small stab incision facilitates subsequent passage of a knot pusher to deliver the suture out the anterosuperior portal. This stab incision should be made before the spinal needle is withdrawn, to avoid cutting the suture in the process.

Care must be taken to ensure that the knot is placed deep to the deltoid and does not capture any muscle tissue in the process.

If the knot is tied under direct visualization in the subacromial space, selective bursectomy should be performed prior to suture passage to avoid cutting the suture with the shaver.

The knot should be tied with the shoulder in 30° to 40° of external rotation to avoid significant loss of motion.

REHABILITATION

Postoperatively, the patient is placed in a shoulder immobilizer at all times except during therapy. Rehabilitation consists of active-assisted, range-of-motion exercises with external rotation to 30° , forward flexion to 140° , and free internal rotation. Closed-chain scapular protraction and retraction exercises are begun immediately, postoperatively. After four weeks, the shoulder immobilizer is discontinued, rehabilitation is advanced to free range-of-motion as tolerated in all planes, and gentle strengthening is initiated with therabands at first, progressing to light weights at six weeks. Return to contact-sports is determined on a case-by-case basis, but is usually permitted at the six-month mark.

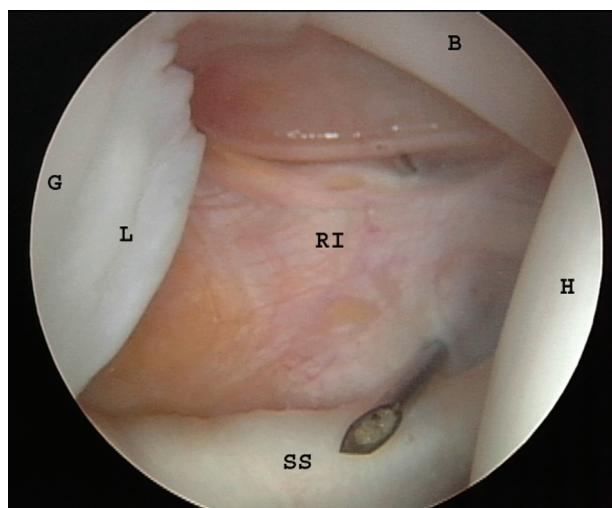


FIGURE 1 Arthroscopic view of the rotator interval. *Abbreviations:* B, biceps tendon; G, glenoid; H, humeral head; L, labrum; RI, rotator interval; SS, subscapularis.

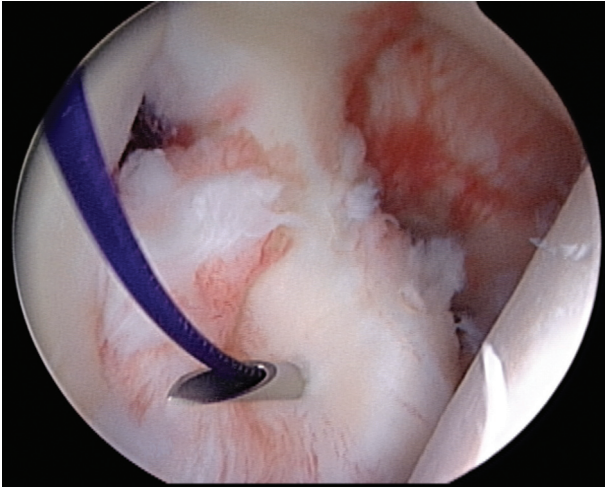


FIGURE 2 Placement of a spinal needle through the middle glenohumeral ligament and capsule.

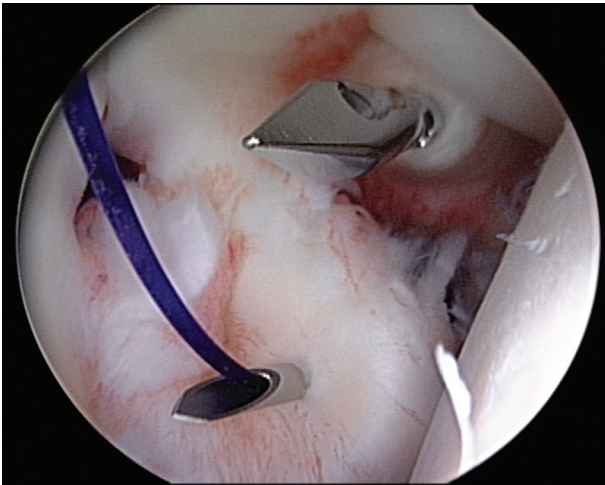


FIGURE 3 Tissue penetrator placed through the superior glenohumeral ligament and anterior capsule.

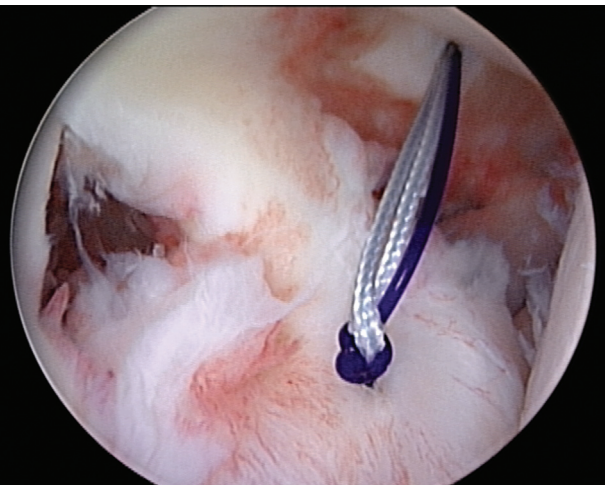


FIGURE 4 Suture shuttled through the tissue.



FIGURE 5 Knot pusher delivering the inferior suture limb through the anterosuperior portal.



FIGURE 6 Both suture limbs delivered through the anterosuperior portal.

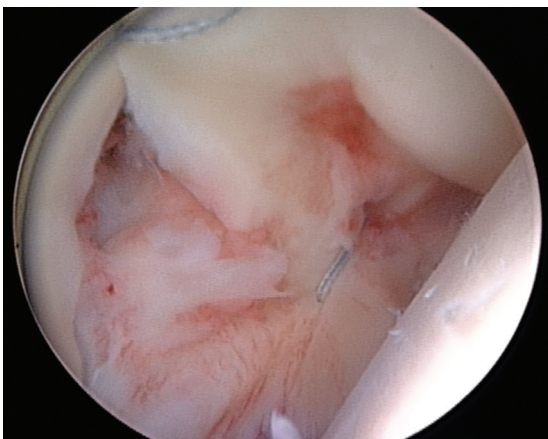


FIGURE 7 Rotator interval closed by tensioning of the suture.

REFERENCES

1. Cole BJ, Rodeo SA, O'Brien SJ, et al. The anatomy and histology of the rotator interval capsule of the shoulder. *Clin Orthop Relat Res* 2001; (390):129–137.
2. Harryman DT II, Sidles JA, Harris SL, et al. The role of the rotator interval capsule in passive motion and stability of the shoulder. *J Bone Joint Surg Am* 1992; 74(1):53–66.
3. Gartsman GM, Roddey TS, Hammerman SM. Arthroscopic treatment of anterior-inferior glenohumeral instability. Two to five-year follow-up. *J Bone Joint Surg Am* 2000; 82-A(7):991–1003.
4. Treacy SH, Field LD, Savoie FH. Rotator interval capsule closure: an arthroscopic technique. *Arthroscopy* 1997; 13(1):103–106.
5. Gartsman GM, Taverna E, Hammerman SM. Arthroscopic rotator interval repair in glenohumeral instability: description of an operative technique. *Arthroscopy* 1999; 15(3):330–332.
6. Cole BJ, Mazzocca AD, Meneghini RM. Indirect arthroscopic rotator interval repair. *Arthroscopy* 2003; 19(6):E28–E31.