Technical Note

Arthroscopic Rotator Interval Repair: The Three-Step All-Inside Technique

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Abstract: Many clinical reports have emphasized the importance of rotator interval lesions in patients with glenohumeral instability, and many investigators have described open repair techniques, either as a supplement to other capsule reconstruction or as an isolated procedure. In this article, an original arthroscopic technique for rotator interval closure is described. This technique allows the operator to accurately manage the degree of tightening of the rotator interval, the knot tying, and the suture cutting, under direct intra-articular arthroscopic vision. **Key Words:** Rotator interval—Repair—Glenohumeral instability.

Early studies on arthroscopic treatment of glenohumeral instability have demonstrated failure rates of as high as 50%.[1] These studies have mainly focused on the repair of lesions of the anterior–inferior labrum.[2]

A very difficult aspect of shoulder stabilization is the identification of all the lesions causing the instability.[3] Among others, capsular and ligament laxity or elongation are present in various degrees in most patients with shoulder instability, and rotator interval (RI) lesions are but one of a host of potential lesions.[3-5]

Anatomic studies have shown a significant increase in inferior and posterior translation of the humeral head after the section of the RI capsule with the concomitant sectioning of the superior glenohumeral (SGHL) and coracohumeral (CHL) ligaments.[5]

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In the literature, we have found numerous clinical reports emphasizing the importance of RI lesions in patients with glenohumeral instability and many reports describing open repair techniques, either as a supplement to other capsule reconstruction or as an isolated procedure.[3,4,6-12] Strangely enough, for many years, the RI repair has been neglected by arthroscopic surgeons, and only recently a few investigators have illustrated arthroscopic techniques for the repair of the rotator interval.[12-17]

The most recent investigations have supported the concept that even anterior–inferior instability is associated with multiple lesions, and that the success rate can be increased by treating lesions simultaneously at the time of the operation.[4]

To have the simplest and most effective arthroscopic rotator interval closure, we have adopted a slightly modified version of this technique, which we have been successfully using for the last 3 years.

NORMAL AND PATHOLOGIC ANATOMY

The term "rotator interval" has two different meanings with reference to the anterior–superior shoulder. When used in conjunction with repair of the rotator cuff, it is the tendinous connection between the supraspinatus (SS) and subscapularis (SubS). When

used in reference to shoulder instability, the RI is defined as the triangular space area of the glenohumeral joint capsule formed by a thin, elastic, membranous tissue between the anterior portion of the supraspinatus and the superior border of the subscapularis tendon.[17]

RI and superior labral lesions represent a spectrum of injuries from the biceps anchor through the RI capsule to the bicipital groove, ranging from lax RI capsule, to small holes, and lesions in which most of the RI capsule is torn.[11]

These lesions occur through similar mechanisms of injury, and present similar symptoms and physical findings. They could be difficult to diagnose, and the full extent of RI lesions cannot always be individuated even arthroscopically.

However, findings consistent with a lesion of the rotator interval are[11,12,14,17]:

1. Redundancy of the capsule between the subscapularis and supraspinatus tendons,
2. Fraying of the biceps tendon as it exits the joint,
3. Tearing of the superior glenohumeral ligament,
4. Tearing of the rotator interval capsule,
5. Fraying of the superior border of the subscapularis tendon, and
6. Flattening and medial dislocation of the biceps tendon.

Because the bicipital groove cannot be inspected arthroscopically, the lesions of the SGHL, CHL, and SubS tendon at this level are missed with arthroscopic evaluation, and other techniques should be performed when these lesions are suspected.[10,11]

SURGICAL TECHNIQUE

General anesthesia with the addition of interscalene block is the preferred anesthetic technique. The patient is placed in a sitting position and an examination of the range of motion and the stability of the shoulder is performed. A posterior portal, 1.5 cm inferior and 1.5 cm medial to the posterolateral corner of the acromion, is established. The arthroscope is introduced into the glenohumeral joint through this portal, and an accurate diagnostic examination of the joint is performed. Two standard anterior portals, adequately spaced so as to allow the repair of any lesion encountered, including the RI tear, are created in arthroscopic glenohumeral reconstruction, preferably by an outside–in technique. A spinal needle is used to locate the precise spot for trocars entrance (Fig 1).

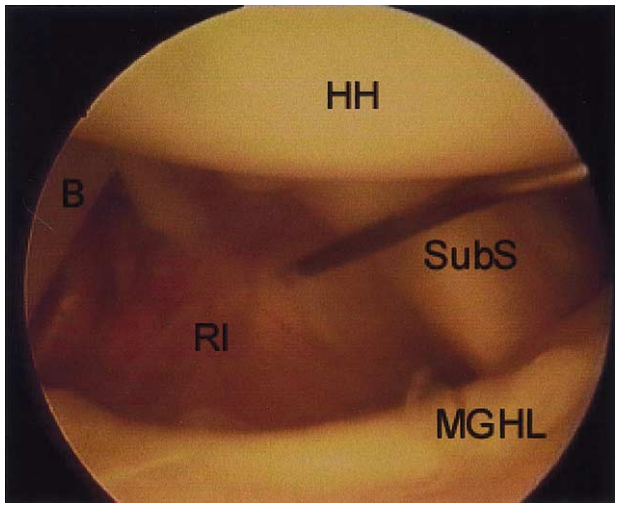

FIGURE 1. Arthroscopic vision of the spinal needle used to locate the precise spot for the anteroinferior portal.

Through an anteroinferior portal, an 8-mm cannula is inserted, so as to enter the glenohumeral joint immediately superior to the subscapularis. The skin incision is usually made just lateral to the coracoid process. Subsequently, an anterosuperior portal is created and a 5.5-mm cannula is inserted into the joint immediately lateral to the biceps tendon, approximately 1 cm lateral to the glenoid.

The skin incision is generally 1 to 2 cm medial and anterior to the anterolateral corner of the acromion.

All other lesions causing instability are detected and repaired first. At this point, if the shoulder demonstrates persistent inferior or inferior–posterior translation and the rotator interval is torn or enlarged, the rotator interval repair is performed. The RI repair should be the last step performed within the glenohumeral joint, because a cannula cannot be inserted anteriorly once the repair is completed. Before starting the RI repair, to reduce the possible loss of external rotation, we position the arm in 30° of external rotation and abduction.

The three-step all-inside repair

Operative Technique

Step 1: The straight Arthropierce suture passer (Smith & Nephew, Andover, MA) is loaded with suture according with the surgeon's preference (we prefer no. 2 braided nonabsorbable suture) and introduced into the joint through the inferior cannula.

The Arthropierce penetrates the soft tissue superior to the SubS tendon or middle glenohumeral ligament

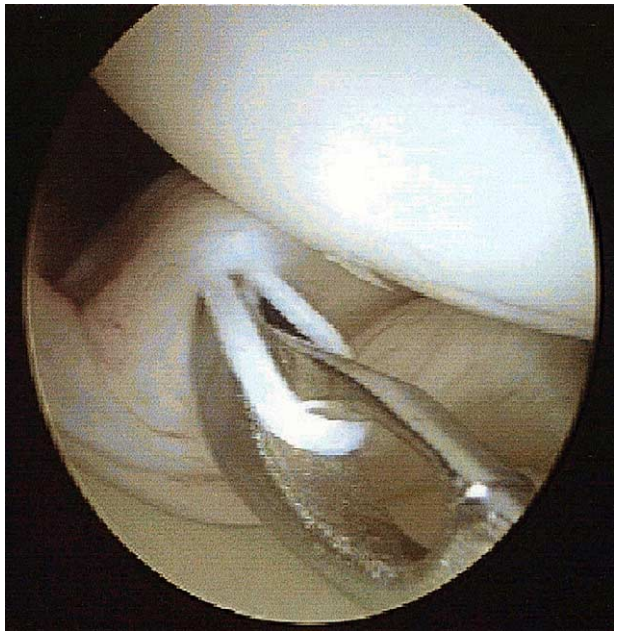

FIGURE 2. Arthroscopic vision of the Arthropierce transporting the suture through the middle glenohumeral ligament.

(MGHL) or SubS tendon, depending on anatomic findings (Figs 2 and 3). One limb of the suture is held by a hemostat out of the inferior cannula.

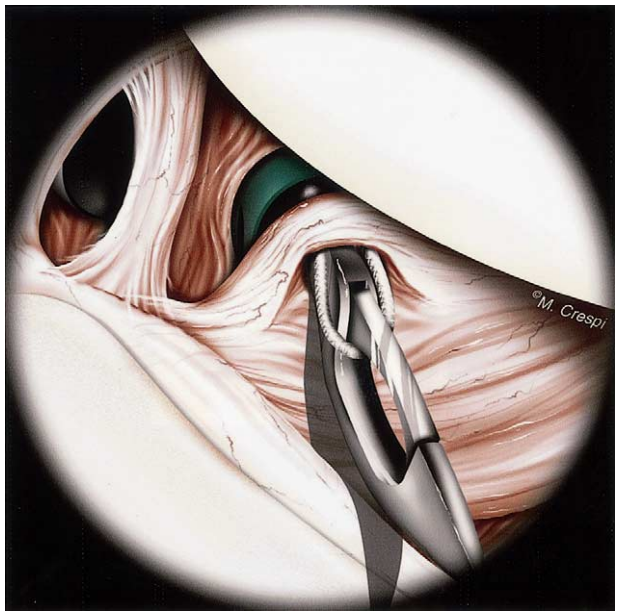

FIGURE 3. Drawing of the Arthropierce transporting the suture through the middle glenohumeral ligament. (Courtesy of M. Crespi.)

FIGURE 4. Drawing of the BirdBeak piercing the superior capsule and grasping the suture from the Arthropierce. (Courtesy of M. Crespi.)

Step 2: In this fashion, the suture is advanced into the joint. The superior cannula is then withdrawn until it is just anterior to the capsule. Then a BirdBeak (Arthrex, Naples, FL) is inserted into the joint through the superior cannula and pierces the superior capsule near the biceps tendon immediately adjacent to the anterior border of the supraspinatus, and while it is in the joint, it grasps the suture and is retrieved out so that this limb of the suture passes through the superior capsule (Fig 4).

Step 3: The suture out of the superior cannula is reintroduced in the joint with a knot pusher (Fig 5) and the transported suture retrieved out of the inferior cannula with a crochet hook or a suture grasper. Tension on the suture will draw the superior capsule and middle glenohumeral ligament together.

When we apply traction on the suture, we assess the translation of the humeral head. If the correction is adequate, a slipknot is tied and advanced down the inferior cannula (Fig 6).

If the correction is inadequate, the suture is removed and placed in a more medial position until excessive translation is corrected. Once the suture is properly positioned, it should draw the superior capsule and MGHL together. If necessary, a second or a third interval-repair suture could be placed, but generally one is sufficient.

At this point, before tying the knot(s), the shoulder

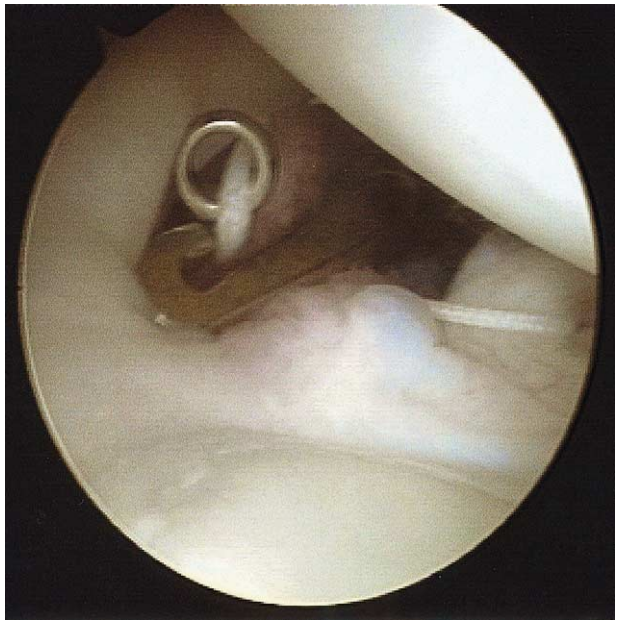

FIGURE 5. Arthroscopic vision of the suture out of the superior cannula reintroduced in the joint with a knot pusher and retrieved out the inferior cannula with a crochet hook.

should be examined for range of motion and stability. It is very important to maintain 30° of external rotation while we tie the knot so that a permanent limit of

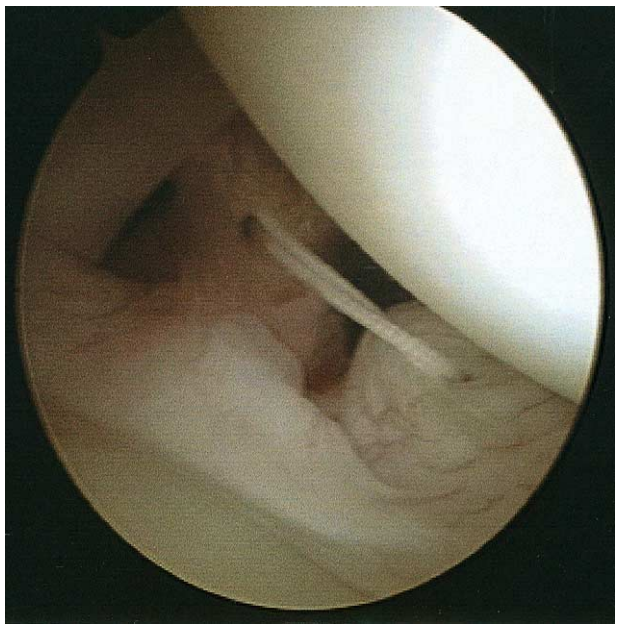

FIGURE 6. Arthroscopic vision of the tension on the suture drawing the superior capsule and middle glenohumeral ligament together.

FIGURE 7. Drawing of the knot tying. (Courtesy of M. Crespi.)

elevation and external rotation is avoided. The change in translation with tension on the interval suture(s) should be compared with translation without tension before knot tying.

The knot, the amount of tightening as well as suture cutting, accomplished with regular arthroscopic scis-

FIGURE 8. Drawing of the rotator interval repair. (Courtesy of M. Crespi.)

sors, can be observed directly under arthroscopic vision (Figs 7 and 8).

DISCUSSION

The role of the rotator interval capsule as primary restraint to inferior and posterior translation of the adducted shoulder has been highlighted by several investigators during the last several years.[3-10]

In a cadaver model, sectioning the RI led to a significant anterior translation of the humeral head with the arm at 60° of flexion.[5]

The most recent studies on glenohumeral instability acknowledge that the spectrum of lesions consistent with instability does not support the concept of any "essential lesion."[4,18]

Thus, among others, an RI lesion is a well-known cause of glenohumeral instability, although its exact role is probably not yet completely understood, and its real incidence among normal and pathologic population is not quite established.[4,5]

An RI lesion is rarely isolated. In most cases of glenohumeral instability, concomitant lesions are present, and a RI lesion is difficult to diagnose, even arthroscopically.[3,4,6-8,10,11,17]

Harryman et al. showed the considerable effect that the embrocation of a surgically created defect in RI could have in reducing posterior and inferior glenohumeral instability.[5]

We agree that reported open[3,6-12] and arthroscopic[4,14-17] repair of the RI, either as a supplement to capsule reconstruction or as an isolated procedure, is effective in controlling instability.

Reported arthroscopic procedures, although effective, require penetration of the subacromial space for knot tying and suture cutting. The amount of capsule tightening cannot be visualized under direct control, and the arthroscope has to be shifted several times from the posterior glenohumeral portal to the anterior bursal one, and vice versa.[15,17]

Our developed technique, named "all-inside," allows us to overcome the aforementioned drawbacks. In fact, the operator can check the amount of tightening of the RI, the knot tying, and the suture cutting under a direct intra-articular arthroscopic vision. In our hands, the described procedure was shown to be simple and effective in treating defects and laxity of the RI.

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