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The Arthroscopic Rotator Interval Closure: Why, When, and How?

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The contribution of the rotator interval (RI) to the overall stability of the glenohumeral joint remains under debate. With improvements in the interpretation of both physical examination and diagnostic imaging findings, the diagnosis of RI pathology is becoming easier to identify. The clinical implications of RI pathology, however, still remain controversial. Injury to RI may contribute to glenohumeral instability, and both biomechanical and clinical studies have shown improvements in anterior shoulder stabilization following RI closure. The benefits of RI repair in the setting of posterior shoulder and multidirectional instability, however, are unclear. The optimal surgical technique is also unclear, and a variety of open and arthroscopic methods have been described. The purposes of this article are to review the surgical anatomy relevant to RI closure, discuss the biomechanical rationale for repairing the RI, and provide our preferred technique for performing arthroscopic RI closure.
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Introduction

Glenohumeral instability remains a challenging problem for even the most experienced of shoulder surgeons. Despite an exponential increase in publications over the past decade covering the entire spectrum of topics related to shoulder instability, several important areas remain unclear. Perhaps more debated than any other instability-related topic within the past 5 years is the issue of rotator interval (RI) pathology.[1-9] Even with the recent plethora of high-quality research conducted by leaders in the field, the following questions remain: what is the true function of the RI, when is RI pathology actually symptomatic, when does RI pathology require surgical correction, and what is the best way to perform these surgeries?

The RI was originally described by Neer[10] in 1970 as the triangular-shaped, anterosuperior space between the supraspinatus (SS) and subscapularis (SSc) tendons. Its contents include the superior and middle glenohumeral ligaments (SGHL and MGHL), the coracohumeral ligament (CHL), a thin layer of capsule, and the long head of the biceps tendon (LHBT). Although the true contribution of the RI to overall shoulder stability is under debate, multiple reports have suggested that the capsule and the RI structures augment joint stability by maintaining negative intra-articular pressure[11] or resisting inferior glenohumeral translation or both.[6,8,12,13] Shoulders with RI insufficiency have certainly been associated with increased glenohumeral translation,[4] and further, shoulders with contractures of the RI have been associated with adhesive capsulitis and even osteoarthritis.[14,15] Surgical imbrication of the RI has been shown to augment surgical correction in specific cases of shoulder instability.[3,6,8,12,13,16-24] In an early report by Rowe et al,[25] 20 of 37 patients with recurrent instability undergoing open anterior shoulder stabilization surgery were found to have some sort of RI lesion, indicating the potential significance of this tissue in overall shoulder stability. It can be difficult, however, to interpret the results of these studies or generalize them to any given patient. The biomechanical studies,[11,12,18-22,24,26-34] for example, are performed in vitro at time zero, without any opportunity for tissue healing and usually without any dynamic constraint (no role of rotator cuff in dissected specimens). The clinical studies are

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equally difficult to combine, as surgical technique, concomitant procedures, rehabilitation protocols, and patient populations differ between studies. Similar to most orthopaedic procedures, there is no current level I data available to guide treatment decisions regarding whether the RI warrants surgical fixation in cases of instability.

One of the well-documented downsides associated with RI repair is the potential for postoperative loss of external rotation, as demonstrated by several cadaveric laboratory studies.[13,18,19,22] In the past, RI closure was commonly performed via invasive, open surgical approaches.[12] Recently however, all-arthroscopic techniques for RI closure have been described.[16,18,20,22,27,32,35-43] The purposes of this article are to review the surgical anatomy relevant to RI closure, discuss the biomechanical rationale for repairing the RI (*why*), discuss the clinical evaluation and indications for surgery (*when*), and to provide our preferred technique for performing arthroscopic RI closure (*how*).

Relevant Surgical Anatomy

The anatomy of the shoulder, and specifically the rotator cuff, has been extensively studied. Along the anterior aspect of the shoulder is a triangular-shaped space between the SS and SSc tendons referred to as the RI (Fig. 1). The base of the triangle is medial, formed by the coracoid process, whereas the apex of the triangle is lateral, formed by the transverse humeral ligament at the lateral ridge of the bicipital groove. The borders of this space (which forms a triangle) include the anterior edge of the SS (superior border), the superior edge of the SSc (inferior border), and the base of the coracoid process (medial border).[2,12,44,45] The actual tissue of the RI is the capsule coming off of the SS and SSc tendons.[29] Jost et al have described the RI in terms of parts and layers. Specifically, the authors describe a "medial part" composed of 2 layers, and a "lateral part" composed of 4 layers. In their cadaveric study, the medial part was noted to limit inferior translation and external rotation, whereas the superior-most layers of the lateral part formed a fibrous plate and were more important in limiting external rotation of the adducted arm.[6]

Several structures including the CHL, SGHL, and LHBT course within the RI.[6,11,12,29,44,46] The CHL originates at the base of the coracoid and splits laterally into 2 bands, with insertions on the anterior edge of the SS tendon and greater tuberosity, as well as on the SSc, the transverse humeral ligament, and the lesser tuberosity. There is some debate as to if the CHL is actually just a thickening of the anterosuperior glenohumeral capsule similar to the other glenohumeral ligaments.[12,15,28,47] The CHL contributes to shoulder stability as it functions to limit external rotation as well as inferior translation.[6] The SGHL originates from the glenoid labrum adjacent to the supraglenoid tubercle (anterior to the LHBT), crosses the floor of the RI deep to the CHL, and inserts onto the lesser tuberosity.[9,12] The LHBT is located between the CHL and the SGHL as it courses through the RI to insert onto the superior aspect of the glenoid.[48]

The distance from the SS to SSc, and thus the size of the RI, varies depending on the position and distention of the shoulder.[6,29] As demonstrated by Tetro et al,[31] the average distance between the anterior edge of the SS and the superior edge of the SSc is approximately 22 mm, which increases to an average 28 mm following joint distention. As described by Plancher et al[29] in an elegant anatomical study, the overall

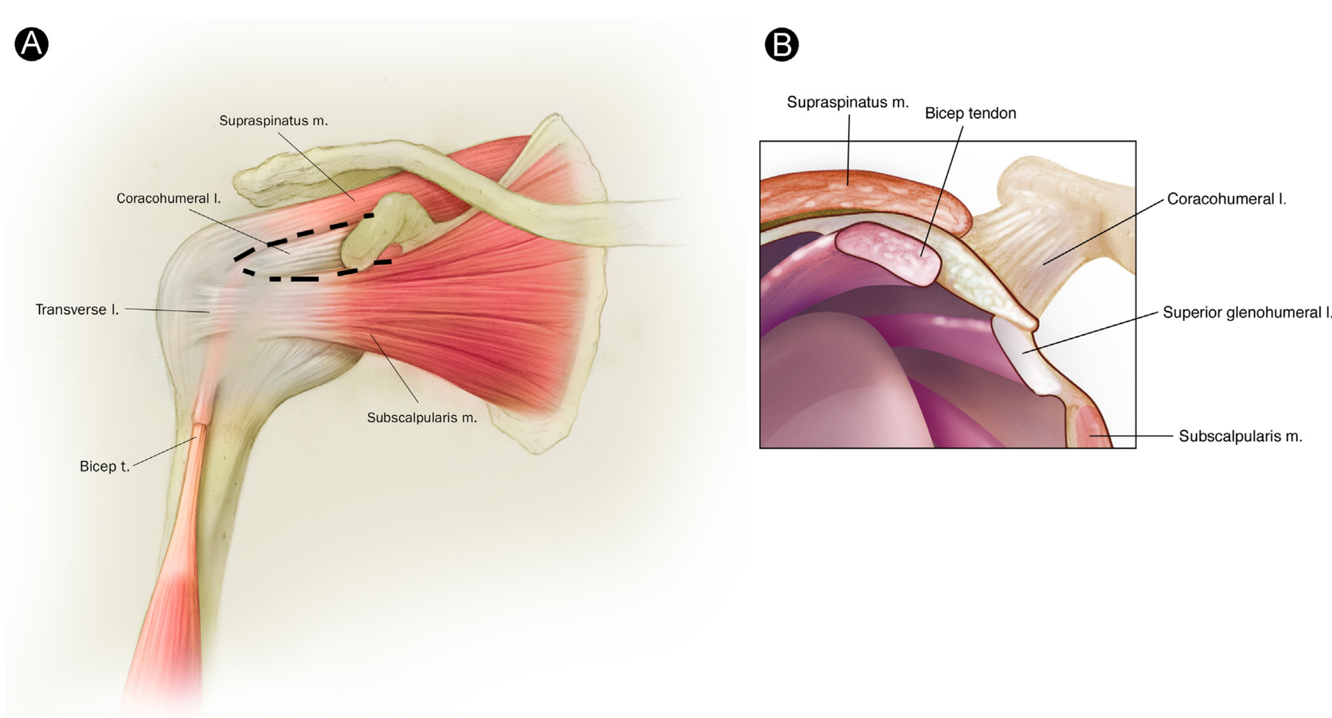

Figure 1 The (A) coronal and (B) sagittal anatomy of the rotator interval (RI).