

ARTHROSCOPIC CAPSULOLABRAL REVISION REPAIR FOR RECURRENT ANTERIOR SHOULDER INSTABILITY

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SUMMARY

Background: Primary arthroscopic Bankart repair for anterior shoulder instability demonstrates reliable outcomes, yet recurrence rates range from 4% to 60%, with revision required in up to 15% of cases. While bone-block procedures effectively address instability, they are associated with risks of graft osteolysis and premature osteoarthritis. Arthroscopic capsulolabral revision repair (ACRR) offers an anatomic alternative for patients without significant osseous defects.

Objective: This article details the preoperative risk assessment, surgical methodology, and clinical outcomes of ACRR for recurrent glenohumeral instability following failed soft-tissue stabilization.

Key Points: Successful ACRR requires rigorous patient selection. Contraindications include glenoid bone loss exceeding 10% of the inferior width, engaging Hill-Sachs lesions, and participation in collision sports. Preoperative evaluation must identify risk factors such as age under 20 years, male sex, and generalized joint hyperlaxity. The surgical technique involves extensive mobilization of the scarred capsulolabral complex, removal of previous hardware, and anatomic restoration using knotless all-suture anchors. For patients with significant capsular redundancy, a posteroinferior capsulolabroplasty is performed to reduce joint volume. Clinical data indicate that approximately 80% of patients achieve good to excellent functional outcomes, with return-to-sport rates between 78% and 84%. However, recurrent instability remains a concern, with reported weighted mean rates of 16% to 26% in the mid-term.

Conclusion: ACRR is an effective anatomic revision strategy for recurrent instability in the absence of critical bone loss. Precise identification of patient-specific risk factors and meticulous capsular management are essential for optimizing clinical success and minimizing recurrence.

KEYWORDS

Joint Instability; Shoulder Joint; Arthroscopy; Reoperation; Suture Anchors

INTRODUCTION

Capsulolabral repair for anterior shoulder instability has been shown to provide reliable clinical outcomes. [1],[2],[3],[4] However, even though arthroscopic instability repair techniques have improved over the last decades, there remains a significant risk of recurrence after the index surgical stabilization. [4],[5],[6],[7],[8],[9] Rates of recurrent shoulder instability after primary anterior capsulolabral repair have been reported to range between 4% to 60% of cases, while revision surgery is performed in up to 15% of these patients.[10],[11],[12]

The most common reasons for recurrent instability after soft tissue-based anterior shoulder stabilization include bony glenoid defects, engaging Hill-Sachs lesions, capsular redundancy, and traumatic events. [13],[14],[15],[16],[17] There is a strong consensus from a clinical and health economic standpoint that bone-block transfers are a suitable procedure in this situation. [18],[19],[20] However, the high risk of development of premature osteoarthritis and graft osteolysis, with pooled mean rates of 28% and 30%, respectively, remain a concern with non-anatomic stabilization procedures such as the Latarjet procedure.[21] Thus, in the absence of severe glenoid bone defects and engaging Hill-Sachs lesions, arthroscopic capsulolabral revision repair (ACRR) has been proposed as a suitable surgical approach, holding the advantages of anatomic labral repair, reduced morbidity, and simultaneous treatment of concomitant intra-articular pathologies. [11],[15],[16],[22]

PREOPERATIVE PLANNING AND RISK FACTOR ANALYSIS

Prior to scheduling a patient with recurrent anterior instability after an index soft-tissue stabilization for ACRR, a detailed analysis of patient-specific and anatomic risk factors for subsequent failure should be performed.

Patient History

It is essential to differentiate patient-specific risk factors associated with the failure of soft tissue repair, which should focus on the type of primary instability (direction of dislocation, type and mechanism of event at onset of instability, number of previous dislocations, potential concomitant muscular disbalances or generalized joint hyperlaxity), the onset and severity of recurrence (differentiation between subluxation or dislocation, onset of symptoms already during activities of daily life, sleep or in midrange motion, potentially indicating severe instability), demographic risk factors (age < 20 years [23] and male sex [24]) and behavioral risk factors (involvement in contact sports or a heavy physical occupation).

Physical Examination

The physical examination should include tests for anterior instability (anterior apprehension test, relocation release tests) and posterior instability (Jerk test, Kim test), as well as the load and shift test for increased anterior and posterior humeral translation. In addition, detecting any signs of capsular hyperlaxity such as a positive sulcus sign, a positive hyperabduction test according to Gagey, a passive external rotation > 90°, and a Beighton score of ≥4 points is of substantial clinical relevance. Treatment of patients presenting with antero-inferior instability and concomitant hyperlaxity remains a major challenge, due to hyperlaxity being an independent risk factor for recurrent instability and a predictor for failure following primary and revision arthroscopic Bankart repair. [25] As previous studies demonstrated a reduction of capsular volume by 57% in the setting of combined

anteroinferior and posteroinferior capsular plication [26],[27], these patients may benefit from an additional suture anchor placed posteroinferiorly at the 7 o'clock position to create a superomedial capsular shift[25]

Surgical History

To determine technical risk factors potentially associated with failure of soft tissue repair, a review of surgical documents relevant for the index shoulder stabilization should include available preoperative imaging, surgical reports, and if possible arthroscopic footage. Imaging performed prior to the index stabilization should be assessed for risk factors such as glenoid bone loss, prevalence of a special labral tear configurations (anterior labroligamentous periosteal sleeve avulsion (APLSA) / humeral avulsion glenohumeral ligament (HAGL)/ superior labrum anterior posterior (SLAP)/ glenolabral articular disruption (GLAD)/Perthes lesion), increased capsular volume indicative of joint hyperlaxity, or a dysplastic labrum, which were potentially overlooked at the index surgery. Further, the number, type and positioning of anchors inserted at index stabilization as well as the compliance during rehabilitation should be assessed.

Radiographic Assessment

The radiographic assessment should comprise standard antero-posterior, axillary, and scapular y-view radiographs, and magnetic resonance imaging (MRI) to detect signs of bone loss, static humeral head subluxation, chondral lesions, labral lesions or deficiency, and capsular redundancy. For sufficiently assessing risk factors for subsequent failure of soft-tissue stabilization procedures in the revision setting, this should be complemented by a computed tomography (CT) scan to precisely quantify bony deformities of the glenoid and humeral head.

Historically, 20% to 25% has been deemed the “critical” cut-off value where glenoid bone loss should be surgically addressed using a bone augmentation procedure.[28],[29] However, a “subcritical” bone loss of 13.5% was recently found to significantly impair functional outcomes following arthroscopic Bankart repair, questioning if these patients would have benefitted from bone grafting.[29] Additionally considering the substantial inter-rater variability of bone loss measurements even in 3D-CT scans described by Lacheta et al.,[30] we have lowered the threshold value for performing a bone augmentation technique in our treatment algorithm to a glenoid bone loss of > 10% of the inferior glenoid width.

In the setting of a bipolar bone defect, composed of glenoid bone loss and a Hill-Sachs lesion, the glenoid track concept has proven its validity in risk stratification. In case of an Hill-Sachs interval greater than the glenoid track, this “off-track” situation requires a bone-based reconstruction or more complex arthroscopic adjunct procedures.[17] Interestingly, Cong et al. found that the inferior extension below the humeral equator (lower-edge angle >90°) of an otherwise on-track Hill-Sachs lesion is a highly predictive risk factor for recurrent instability after primary arthroscopic Bankart repair.[31] Consequently, we have recently included the lower-edge angle as a measure of Hill-Sachs caudal extension into our risk factor assessment, as some patients with on-track lesions may benefit from a remplissage procedure.[31]

INDICATION FOR ARTHROSCOPIC CAPSULOLABRAL REVISION REPAIR

Considering the previously described risk factor analysis for failure, ACRR is performed at our institution in patients with recurrent anterior instability after an open or arthroscopic index surgical soft-tissue-based anterior stabilization procedure with a glenoid bone defect of less than 10% of the inferior glenoid width and non-engaging

Hill-Sachs lesion. Further, ACRR is only performed in patients not regularly participating in collision sports or with very heavy physical occupation.

SURGICAL TECHNIQUE

Patient Positioning

General anesthesia as well as additional local anesthesia via an interscalene block are administered. The patient is positioned in the lateral decubitus position for sterile preparation and draping. The position of the patient is secured in a vacuum mattress and both ventral and dorsal support. For adequate distraction of the glenohumeral joint traction is applied to the operative arm via a sling and a gallows frame. A physical examination under anesthesia assessing pathologic humeral translation and subluxation or dislocation as well as capsular laxity is performed to confirm the diagnosis.

Diagnostic Arthroscopy

First, a standard posterior viewing portal is established parallel to the joint line. During a standard diagnostic arthroscopy labral configuration, capsular volume, and concomitant pathologies are documented. Special attention is given to the assessment of the Hill-Sachs lesion. An anteroinferior portal at the lateral upper edge of the subscapularis tendon is established. A cannula (Twist-In, Arthrex Inc., Naples, FL) is placed in the anteroinferior portal. Then an anterosuperior viewing portal is established in the rotator interval and posterior to the long head of the biceps tendon. Under visualization via the anterosuperior portal, a cannula (Gemini, Arthrex Inc., Naples, FL) is positioned in the posterior portal.

Tissue Mobilisation and Anchor Placement

Subsequently, the retracted labrum and the scarred capsule are mobilized from the scapular neck down to the 6:00 or even 7:00 o'clock position using an arthroscopic tissue elevator or an electrofrequency device in severe retracted and scarred tissue. Previous suture material and loose anchors are carefully removed. The glenoid rim is then debrided using a shaver or Bankart rasp and the anchor insertion sites are prepared with light decortication to allow healing of the capsulolabral complex (Figure 1). The goal of tissue mobilisation is a tension-free reduction of the capsulolabral tissue on the glenoid rim. By stopping the arthroscopic fluid inflow, a self-reduction of the tissue can be observed when the capsulolabral tissue is appropriately released from its adhesions and scarring.

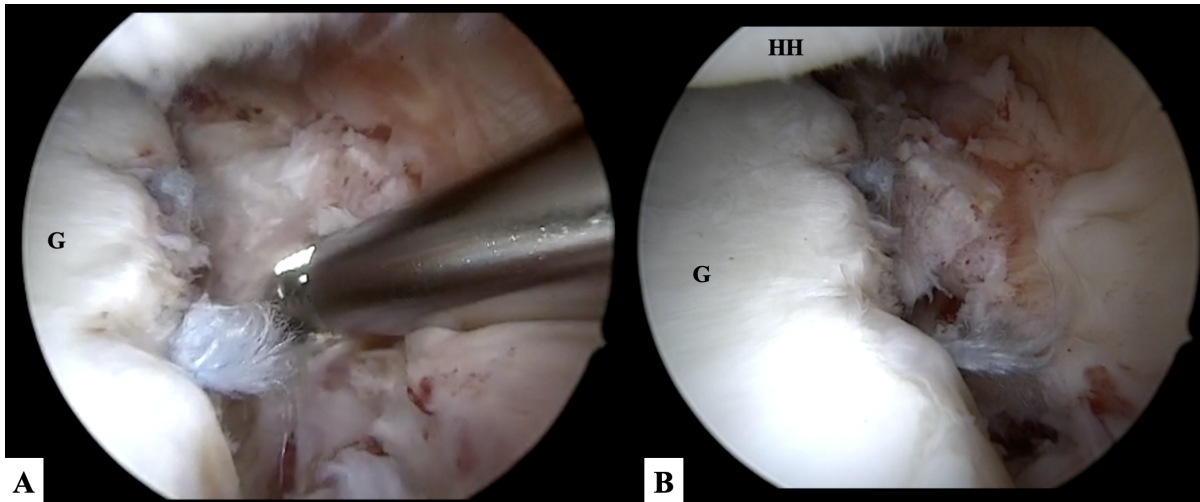


Figure 1: (A) Removal of suture material and debridement of the anterior glenoid rim using an arthroscopic shaver. (B) Debrided anterior glenoid rim with remaining suture material from the index stabilization.
 Abbreviations: G = glenoid; HH = humeral head

Next, a subscapularis split portal is created and a curved drill guide (Arthrex Inc.) including a sharp obturator is inserted under arthroscopic visualization. The obturator is carefully removed, and the guide placed approximately 2 mm to the articular rim at the most inferior repair position (5:30 o'clock). Once the correct position is ensured in a 135° orientation to the glenoid plane, a flexible 1.8mm drill is used to drill the respective tunnel (Figure 2A). Via the drill guide, a 1.8mm knotless all-suture anchor (Fibertak, Arthrex Inc.) is gently driven in as far as the drill guide allows (Figure 2B).

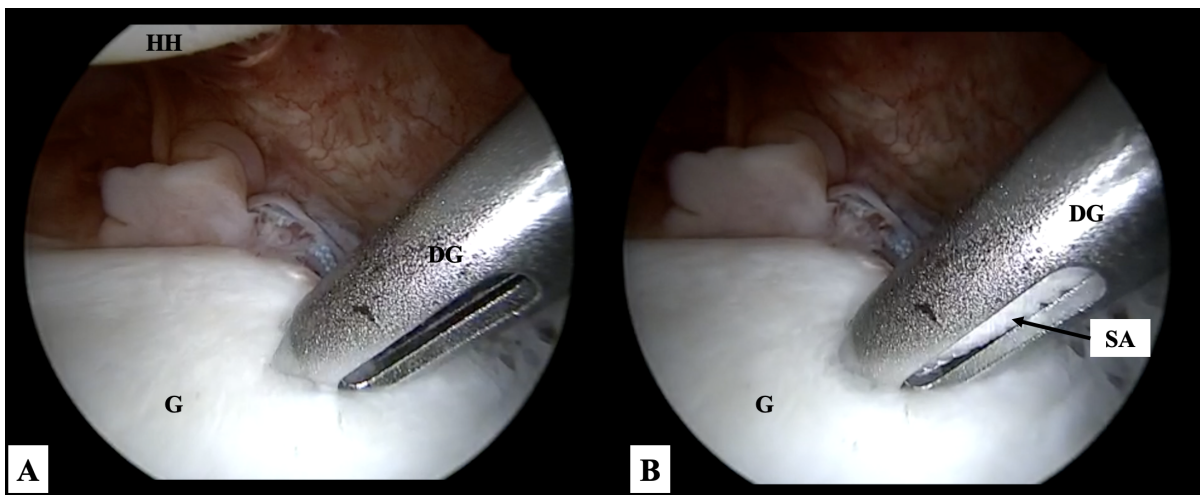


Figure 2: (A) Placement of the drill guide at the 5:30 o'clock position approximately 2mm from the articular rim. (B) The 1.8mm knotless all-suture anchor (Fibertak, Arthrex Inc.) is inserted. Abbreviations: DG = drill guide; G = glenoid; HH = humeral head; SA = suture anchor

The handle and drill guide are removed leaving the sutures in place, which are then pulled on all together to assess stability and allow for proper seating of the anchor. For precise and successful placement of the anchor it is critical not to change the drill guide's position and orientation when retracting the drill from the joint.

Subsequently, the blue repair suture is retrieved through the posterior portal. Via the anteroinferior portal, a 25° curved tissue penetrator and shuttling device (Suture Lasso, Arthrex Inc.) is inserted and rotated to penetrate the

capsulolabral complex and emerge at the chondrolabral junction just inferior to the anchor site (Figure 3A). A nitinol wire is shuttled through and retrieved via the posterior portal, which is then used to shuttle the repair suture back in standard fashion and pass it through the capsulolabral complex (Figure 3B).

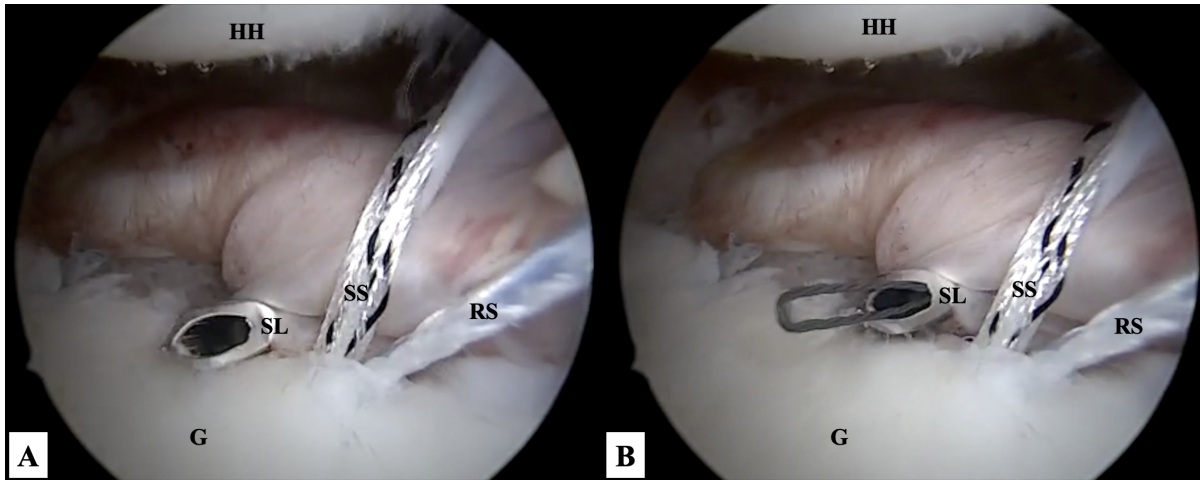


Figure 3: (A) Via the anteroinferior portal, a 25° curved tissue penetrator and shuttling device (Suture Lasso, Arthrex Inc.) is inserted and rotated to penetrate the capsulolabral complex and emerge at the chondrolabral junction just inferior to the anchor site. (B) A nitinol wire is shuttled through and retrieved via the posterior portal, which is then used to shuttle the repair suture back in standard fashion and pass it through the capsulolabral complex. Abbreviations: G = glenoid; HH = humeral head; RS = repair suture; SL = suture lasso; SS = shuttle suture

After switching the arthroscope to the posterior portal, the blue repair suture and the shuttling suture are retrieved via the anterosuperior portal to avoid entanglement of the sutures. The repair suture is then loaded through the loop end of the shuttling suture and the free end of the shuttling suture (tape) is pulled to shuttle the repair suture through the anchor until the desired tension is achieved (Figure 4).

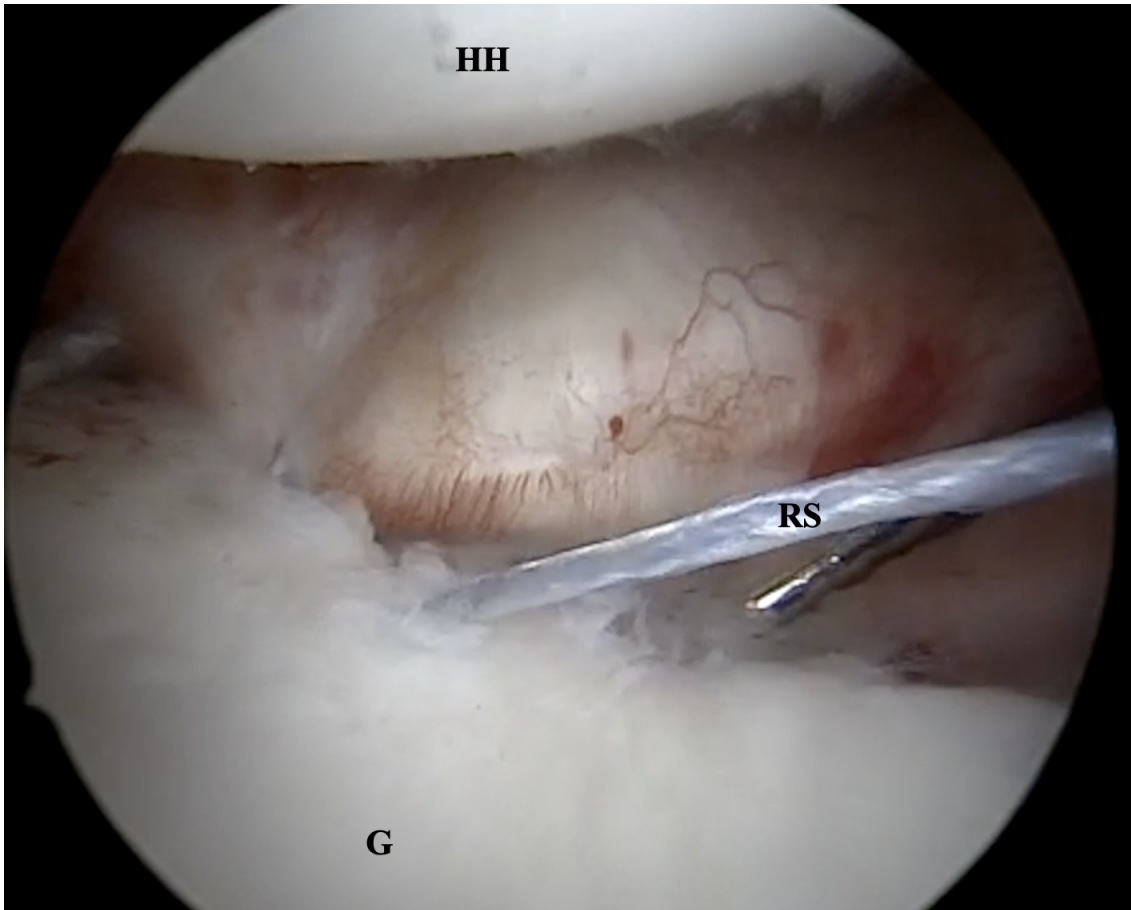


Figure 4: The repair suture is loaded through the loop end of the shuttling suture and the free end of the shuttling suture (tape) is pulled to shuttle the repair suture through the anchor until the desired tension is achieved. Abbreviations: G = glenoid; HH = humeral head; RS = repair suture

Before the free end of the shuttling suture is pulled it should be ensured that both ends of the shuttling suture are running smoothly through the anchor. Additional 2 to 3 anchors are then placed at the anterior glenoid ascendingly covering the 4:00, and 3:00 o'clock positions. At the end of surgery, the repair sutures are re-tensioned one by one from caudal to cranial to remove any remaining slack and are finally cut flush with the tissue (Figure 5). [15]

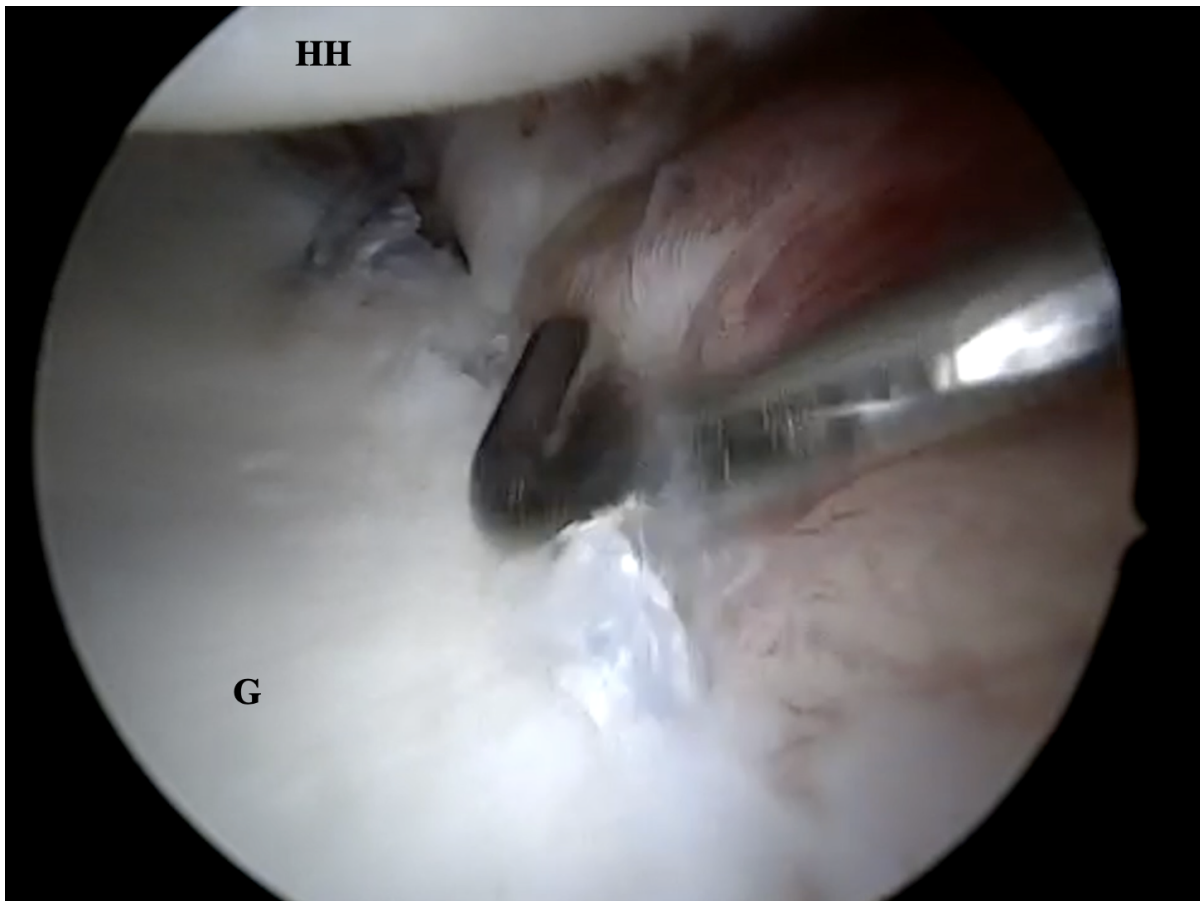


Figure 5: After cutting the repair sutures the finally resulting labral bumper is evaluated with an arthroscopic probe. Abbreviations: G = glenoid; HH = humeral head. Abbreviations: G = glenoid; HH = humeral head.

Posteroinferior Capsulolabroplasty

In patients with clinical signs of hyperlaxity or significant capsular laxity left after the anterior capsulolabral repair, an additional posteroinferior capsulolabroplasty is performed. The posteroinferior labrum is carefully mobilized without complete detachment through the posterior portal. Next, a posterolateral working portal 2 cm inferior and lateral to the posterior viewing portal is established using the curved guide including the sharp obturator under arthroscopic visualization from the anterosuperior portal. The guide is placed at the 7:00 o'clock position and the repair and shift is performed similarly to the anterior repair using a 1.8mm knotless all-suture anchor (Fibertak, Arthrex Inc.).

POSTOPERATIVE REHABILITATION

Postoperatively, patients were placed in a shoulder sling for 6 weeks along with the following allowed range of motion:

- 1st-3rd postoperative week: Active-assistive Abd./Add.: 45°/0°/0°, active-assistive Flex./Ext.: 45°/0°/0°, active assistive I.R./E.R.: 80°/0°/0°.
- 4th-6th postoperative week: Active-assistive Abd./Add.: 90°/0°/0°, active-assistive Flex./Ext.: 90°/0°/0°, active-assistive I.R./E.R.: 80°/0°/0°.
- From the 7th postoperative week on: Full range of motion allowed.

- From the 6th postoperative month: Overhead sports permitted.

During the time of rehabilitation exercises for stabilizing the scapular setting and scapulothoracic rhythm should be performed regularly.

DISCUSSION

In a recent systematic review analyzing clinical outcomes after ACRR, it was found that 79.7% of patients reported experiencing good to excellent functional outcomes after a mean follow-up of 3.1 years.^[12] Postoperatively, the included patients achieved a mean Rowe score of 84.2, mean Constant score of 87.9, mean SST score of 10.8, and VAS score of 1.9.^[12] Another important outcome measure for postoperative success after ACRR is the assessment of return to sports and level of play after surgery, especially in these young and physically active patients usually suffering from recurrent shoulder instability.^{[32],[33],[34],[35]} In a systematic review evaluating sports activity after ACRR, the authors found an overall rate of return to sports of 78.5%, however, only 47.5% of patients returned to their pre-injury level of play.^[12] In addition, Lau et al. showed in a more recent systematic review that the weighted mean rate of return to play was 84.0% after a mean follow-up of 39.1 months, while the reported time to return to play showed a weighted average of 7.8 months.^[32] Interestingly, 69.7% of patients returned to the same level while 27.3% returned to a lower level of play.^[32]

When looking at failure rates after ACRR it has been shown that recurrence of instability ranged between 0% and 41.5% of cases at a mean follow-up of 39.5 months.^[10] More specifically, the weighted mean recurrent instability rate was 16.0%, along with a weighted mean revision surgery rate of 9.0%.^[10] In addition, Haskel et al. found an overall rate of recurrent instability of 26.2% of cases at a mean follow-up of 37.6 months.^[12] Interestingly, the number of previous surgeries and hyperlaxity have been shown to be significant risk factors for failure.^[36] Further, the presence of off-track lesions, age of over 22 years, and ligamentous laxity have been described as independent predictors of recurrence.^[37]

In general, previous work pertaining to functional outcomes, return to sports as well as failure and revision rates after ACRR are limited to only a short- to mid-term follow-up ranging from 1.8 to 5.8 years.^{[10],[12],[15],[32],[38]} Future studies will show if outcomes after undergoing ACRR, including functional scores, sports activity as well as failure and revision rates, will be maintained over the long-term.

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