Combined Double-Pulley Remplissage and Bankart Repair

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Abstract: The use of arthroscopic Bankart repair to treat anterior shoulder instability has become increasingly widespread. However, high rates of recurrent instability within the presence of glenohumeral bony defects, specifically Hill-Sachs lesions, have well documented a key concern regarding the arthroscopic Bankart repair process. Our technique describes the pairing of a remplissage to fill the Hill-Sachs lesion with the Bankart repair, preventing loss in shoulder stiffness and stability. This technique involves a double-pulley-combined remplissage and Bankart repair to maintain a low-failure, minimally invasive procedure.

Introduction

The glenohumeral joint is the major joint determining shoulder stability, and given its high mobility and various anatomical and biochemical purposes, shoulder dislocations sit among the top of all major joint dislocations rates.1–4 Of said subluxations and dislocations, anterior shoulder dislocation induced by anteroinferior instability of the humeral head is the most common, with incidence rates of up to 25 per 100,000 person-years in the general population.1,3–6

Currently, the most popular surgical option for anterior shoulder instability consists of arthroscopic Bankart repair in cases with minimal or no bone loss.6–11 However, concerns over the elevated rates of isolated surgical failures and shoulder instability recurrence within the presence of glenohumeral bony defects and/or lesions remain.8,10–17 The elevated recurrence rates may be primarily attributed to reduced shoulder stiffness induced by Hill-Sachs defects and other bony defects.11,18

The Hill-Sachs defect is characterized by a depression on the posterolateral humeral head and is observed in up to 80% of recurrent shoulder dislocations.10,11,19–21 As a result, arthroscopic Bankart repairs have been increasingly paired with remplissage procedures to fill the lesion by reducing the infraspinatus tendon to the humerus.10,12–13 Alternative surgical treatment options for anterior shoulder instability with glenohumeral bone defects consist of glenoid reconstruction procedures, such as distal tibia allografts and autogenous iliac crest bone grafts,22,23 and procedures addressing the humeral bone deficiency, including osteochondral allograft transplantations,24,25 and the Latarjet procedure.26–28

Given the many glenohumeral patterns of recurrent shoulder instability following isolated arthroscopic Bankart repair, soft-tissue stabilization Bankart repairs may be paired with arthroscopic remplissage.8,10,11,14,29,30 The purpose of this technique is to provide a convenient, step-by-step, method for addressing both a labral tear and Hill-Sachs lesion simultaneously. The presented technique and accompanying Video 1 detail the combined arthroscopic Bankart and double-pulley remplissage procedure using only 2 portals and knotless sutures.

Surgical Technique

Preoperative Considerations

Preoperative assessment involves taking the patient’s history, conducting a physical examination of the patient,
and imaging the patient to assess for labral tears and Hill-Sachs lesions. Ultrasound and magnetic resonance imaging can further assist with diagnosis and preoperative planning. Preoperative magnetic resonance imaging of the patient’s left shoulder indicates anteroinferior labral tear, consistent with labral Bankart repair extending to the anterior mid-labrum. Additionally, impaction of the posterolateral humeral head occurs with edema, consistent with Hill-Sachs impaction fracture.

**Patient Positioning**

The patient is positioned on the operating room table in the supine position for induction of general anesthesia. The patient is then repositioned into the beach chair position with the left shoulder and arm positioned using a Trimano limb positioner. The left shoulder is prepared with preoperative skin prep solution proximally from the shoulder to the hand and is draped in the usual sterile fashion (Video 1).

**Diagnostic Arthroscopy**

Anatomic landmarks are identified and marked. A standard posterior portal is made with no. 11 blade and bluntly dilated with scope sheath and trocar. Diagnostic shoulder arthroscopy is performed, and the large posterior humeral head osteochondral defect with associated loose bodies and anterior labral tear is easily identified. Viewing from the anterior portal with a 4-0 mm 30° angled arthroscopic camera, the damaged labrum is also identified. Then viewing from the posterior portal, the Hill-Sachs defect is identified and prepared using a 4-0 shaver to gently debride soft tissue (Fig 1).

**Remplissage Preparation**

Percutaneous access is placed, via needle localization, superolateral and posterolateral to the posterior portal for anchor placement (Fig 2). A punch is used to create a pilot hole (Video 1), and a double-loaded 5.5 mm BioComposite corkscrew suture anchor from Arthrex is placed within the defect perpendicular to the lesion. A second Arthrex suture anchor of the same type is placed in the same fashion, so that they are spaced evenly within the lesion, sitting in an inferior/superior configuration (Fig 3). Each suture anchor is loaded with a repair suture. Remplissage anchor placement is first completed to avoid Bankart repair disruption.

**Bankart Repair**

An anterior portal is established in the rotator interval from outside in using a spinal needle localization. An 8.25-diameter corkscrew cannula is placed lower, just superior to the subscapularis tendon. This cannula is placed low in order to reach the most inferior portion of the glenoid. A 4.25-mm shaver is then used to debride the anterior labral tear prior to elevation of the scarred labral tear using a probe. No bony component to the Bankart injury is identified.

A ReelPass from Arthrex is used to pass 0-PDS around the injured anterior labrum (Fig 4). The passed end of this suture is then retrieved through the anterior portal and tied to no. 2 FiberWire. The 0-PDS is then used to shuttle the FiberWire around the labrum in a looped fashion (Video 1). The free ends of the FiberWire suture are retrieved and passed through the looped end, and by doing so, a stitch is established around the damaged labrum (Fig 4). The PushLock drill and drill guide establish a single pilot hole to the adjacent glenoid (Fig 5). The labral FiberWire suture is then loaded into a 2.9 mm BioComposite PushLock from Arthrex prior to using a mallet to place these into our guide hole under tension (Fig 5). This process is repeated three additional times, stitching and anchoring three additional FiberWire and...
PushLock sutures to the anterior inferior labrum for a total of four PushLock suture anchors to complete the Bankart repair (Video 1).

**Double-Pulley Remplissage**

After completion of the labral repair, the sutures from one of the anchors of the preliminary remplissage sit inferior to the infraspinatus tendon, while the sutures from the second anchor sit superior to the infraspinatus tendon. The repair suture from anchor 1 and the FiberWire sutures from anchor 2 are retrieved through the percutaneous portal. The repair sutures from anchor 1 are then tied to the sutures of anchor 2 in a parallel fashion (Fig 6). This is then tensioned down within the subacromial space, over the infraspinatus tendon, by pulling the excess end of the repair suture that has been pulled through anchor 2 and reducing the infraspinatus down into the Hill-Sachs lesion. The reduction is tensioned and secured by a surgeon’s knot with a knot pusher (Fig 6). The excess suture is then cut once adequate tension has been achieved (Fig 7). Pearls and pitfalls of the surgical technique are presented in Table 1.

**Postoperative Care**

The arthroscopic wounds are closed with 3-0 nylon, covered in xeroform, and dressed in 4×4 abdominal (ABD) pad and Medipore tape. The shoulder is stabilized with an immobilizer sling for 6 weeks. The goal during these 6 weeks is to avoid elevation and lifting with the operative limb. Scapular isokinetic and pendulum exercises are performed in physical therapy. From 6 weeks postoperatively onward, sling use is discontinued, and the patient begins strengthening physical therapy.

**Discussion**

Various clinical considerations must be considered when choosing between different surgical approaches for anterior shoulder instability. Within the presence of glenohumeral bony lesions, such as the Hill-Sachs defect, an isolated arthroscopic Bankart repair may not be enough to present a suitable long-term solution with other isolated procedures presenting as alternatives. Thus, the addition of the remplissage procedure to address high recurrence rates of shoulder instability has
been the subject of many studies. A systematic meta-
analysis of six studies carried out by Buza et al.13 displayed reduced failure rates of arthroscopic remplissage following arthroscopic Bankart repairs than those of isolated arthroscopic Bankart repairs done on patients with unsubstantial to no Hill-Sachs lesions, indicating the potential of remplissage in tackling the prominent issue with arthroscopic Bankart repairs in the presence of glenoid bony lesions. Furthermore, in a direct comparison between isolated Bankart repairs and Bankart repairs with added remplissage, Camus et al.16 noticed through their meta-analysis that there were substantial reductions in recurrent instability in cases with engaging Hill-Sachs lesions, and up to 20-25% glenoid bone loss. Additionally, the study observed no negative shifts in clinical benchmarks, noting insignificant reductions in reoperations and return-to-sport rates. This is further substantiated by additional literature analyses, indicating reduced recurrence rates, lack of additional complications, and comparable postoperative glenohumeral range of motion under similar conditions.32,33

When compared to the Latarjet procedure, a popular alternative for treating anterior shoulder instability, combined remplissage and Bankart repairs present statistically comparable recurrence rates of 3.4% to 5.4% versus 3.5% to 5.7%.7,8,13,27,29,33,34 However, Yang et al. identified sizeable divergences in recurrence rates within revision cases (34.8% for remplissage and Bankart vs 10.3% for Latarjet) and for cases with substantial glenoid bone loss (28.6% for remplissage vs 6.06% for Latarjet).15 Regarding the latter subfactor, literature is largely undecided on what constitutes the percentage of glenoid bone loss past which the Latarjet procedure would be favored, ranging from 10% to 25%.35,36 Additionally, multiple studies have found significantly higher complication rates for open and arthroscopic Latarjet procedures (~7.5% to 30%).
compared to arthroscopic remplissage (1.0% to 5.4%). The elevated Latarjet procedure complication rates can be attributed to various intra-operative and postoperative factors, namely vascular damage, neurological injuries, and hematoma. Concerning additional clinical benchmarks for remplissage versus Latarjet, literature seems to suggest comparable to marginally higher return-to-sport rates, reduced internal rotation motion (40.9° vs 53.2°), increased risk of reduced external rotation motion with abduction, and inconclusive results regarding post-operative pain, with a few studies hinting at neutral to higher marks. Currently, a general lack of long-term follow-up studies regarding said clinical evaluations limit discussion specificity.

Our proposed technique of combined arthroscopic Bankart repair with remplissage allows for the use of a minimally invasive procedure with low morbidity and low rates of complications while maintaining success and recurrence rates similar to those of the open Latarjet procedure in cases with subcritical glenoid bone loss. Moreover, the proposed double-pulley technique used for the remplissage procedure minimizes the number of portals necessary for the operation (Video 1), thus reducing the operative time and the technical difficulty of the surgical treatment. Such advancements in technical efficiency and success rates of the arthroscopic Bankart repair with remplissage compounded with further research can help guide surgeons to make the correct procedural decision regarding anterior shoulder instability. Advantages and disadvantages are presented in Table 2.

Table 2. Advantages and Disadvantages

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<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
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<tr>
<td>Reduces operative time by conducting both procedures a consecutive and organized manner</td>
<td>Unable to view subacromial space during knot tying</td>
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<tr>
<td>Reduces the number of portals required and, thus, postoperative morbidity</td>
<td>Must keep track of suture management during remplissage preparation stage</td>
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<tr>
<td>Larger separation of remplissage anchors without tendon bunching in lesion</td>
<td>Technically challenging to keep attention to both procedures simultaneously</td>
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<td>Allows for larger lesions to be treated through remplissage</td>
<td>Can lead to reduction in postoperative external rotation</td>
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<td>Knot tying more convenient and accessible outside the shoulder</td>
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</tr>
<tr>
<td>Disadvantages</td>
<td></td>
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<tr>
<td>Improper suture management can lead to tying of sutures from same anchors</td>
<td></td>
</tr>
<tr>
<td>Inefficient portal and subsequent anchor placement can increase risk of anchor failure and impair reduction</td>
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Table 1. Pearls and Pitfalls

<table>
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<tr>
<th>Pearls</th>
<th>Pitfalls</th>
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<tr>
<td>Space remplissage anchors adequately for accurate reduction and proper coverage</td>
<td>Improper suture management can lead to tying of sutures from same anchors</td>
</tr>
<tr>
<td>Conduct remplissage anchor placement first to avoid Bankart repair disruption</td>
<td>Inefficient portal and subsequent anchor placement can increase risk of anchor failure and impair reduction</td>
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<td>Keep track of sutures from preliminary remplissage for easier suture management</td>
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Fig 7. Patient is positioned in the beach chair position with the left shoulder and arm positioned with a Trimano limb positioner. Intraoperative arthroscopic imaging of the posterolateral humeral head, as seen through the anterior portal, confirms the reduction of the infraspinatus into the Hill-Sachs defect, indicating the completion of the remplissage.

References

8. Liu JN, Gowd AK, Garcia GH, Cvetanovich GL, Cabarcas BC, Verma NN. Recurrence rate of instability...


