Technical Note

Anterior Arthroscopic Approach for Multidirectional Shoulder Instability: Posterior Bone Block, Dynamic Anterior Stabilization, and Modified McLaughlin

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Abstract: Multidirectional shoulder instability represents an ongoing challenge for orthopaedic surgeons, and multiple techniques have been described to treat this condition. Posterior glenoid dysplasia is a known risk factor for posterior instability as well as persistent or recurrent instability following posterior stabilization procedures. Recurrent shoulder instability complicated by capsular insufficiency due to underlying soft tissue disorders or multiple prior failed surgical procedures poses a challenging surgical problem. A complex salvage surgery with multiple procedures is presented for patients with multidirectional instability or hyperlaxity, with an important posterior erosion component (mainly glenoid dysplasia) and loss of the anterior wall in previous surgical procedures to theoretically reduce recurrent dislocation rates. An anterior arthroscopic approach, including posterior bone block, dynamic anterior stabilization, and modified McLaughlin technique, is described in the present article.

A multitude of treatment options are available for complex cases of multidirectional shoulder instability (MSI) occurring in patients with traumatic or atraumatic instability and associated multidirectional hyperlaxity.[1,2] MSI is a condition characterized by instability of the glenohumeral joint in at least 2 planes, typically anterior and posterior.[1,3] It commonly presents bilaterally and occurs most frequently between the second and third decades of life.[1,2] Multiple causes include generalized ligament laxity in congenital connective tissue disorders, such as Ehlers-Danlos and Marfan syndromes, as well as microtraumas from overuse in athletes like volleyball players, swimmers, throwers, and gymnasts.[1,3] Symptoms can vary and may include nonspecific pain, weakness, paresthesia, subluxations, or recurrent luxation.[1-3]

An accurate diagnosis of MSI and differentiation from unidirectional instability (UI) is important because using surgical management for UI would not address MSI and could result in postsurgical failure and recurrent instability.[1,2] The failure rate after surgical management for unidirectional instability varies between 5% and 30%.[2] The causes can be divided into patient selection errors, technical mistakes, and postsurgical traumatic incidents.[2]

Glenoid dysplasia is thought to be a result of scapular developmental anomaly.[4] It is associated with a deficiency of the osseous posterior rim, malformation of the mechanical alignment or orientation of the socket (increased retroversion), and hyperplasia of the posterior labrum and cartilage.[4] The alteration in the articular alignment resulting in a posteriorly oriented glenoid surface relative to the scapula is a known risk for posterior instability as well as

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Received March 9, 2024; accepted May 8, 2024.

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2212-6287/24399
https://doi.org/10.1016/j.eats.2024.103115

persistent or recurrent instability following a posterior stabilization procedure.[4] Also, importantly, MSI or hyperlaxity with a main component of posterior glenoid dysplasia should be the main focus of the surgery.

A complex salvage surgery with multiple procedures is presented for patients with multidirectional instability or hyperlaxity, with an important posterior erosion component (mainly glenoid dysplasia) and loss of the anterior wall in previous surgical procedures to theoretically reduce recurrent dislocation rates. An anterior arthroscopic approach, including posterior bone block, dynamic anterior stabilization (DAS), and modified McLaughlin technique, is described in the present article.

Surgical Technique

Our surgical technique is demonstrated in Video 1. The indications and contraindications are shown in Table 1, the pearls and pitfalls are summarized in Table 2, and indications and contraindications are listed in Table 3.

Preoperative Evaluation and Surgical Decision

Multidirectional instability can be found in patients who have experienced their first dislocation episode before age 22 years and who have hyperlaxity. They may also have a history of surgical management for unidirectional instability with failed results. During the physical examination, it is important to assess the glenohumeral joint stability in all planes. Additionally, the Beighton scale should be used to evaluate the degree of laxity.

Radiologic studies are essential to assess previous surgical interventions and rule out associated injuries such as fractures, rotator cuff lesions, and glenohumeral bony or chondrolabral defects, as well as to quantify these accurately.

Table 1. Indications and Contraindications for Using the Anterior Arthroscopic Approach for Multidirectional Shoulder Instability With the Posterior Bone Block, Dynamic Anterior Stabilization, and Modified McLaughlin Technique

Indications	Contraindications
Multidirectional instability or hyperlaxity, with an important posterior erosion component (mainly glenoid dysplasia) and loss of the anterior wall in previous surgical procedures	No posterior dysplasia or multidirectional instability without posterior predominance
Failure of other techniques (Bankart repair, Latarjet, Putti platt, etc.)	Axillary neuropathy
	Glenohumeral osteoarthritis

Table 2. Pearls and Pitfalls of Using the Anterior Arthroscopic Approach for Multidirectional Shoulder Instability With the Posterior Bone Block, Dynamic Anterior Stabilization, and Modified McLaughlin Technique

Pearls	Pitfalls
The patient in a beach-chair position, which provides an easy and comfortable way to work. Sometimes, a pneumatic support (e.g., Trimano) can be used to facilitate the surgery.	Risk of supraspinatus, biceps, and subscapularis lesions when opening the rotator interval.
Few portals are used for the entire procedure.	If the rotator interval does not open adequately, entering the glenohumeral joint for visualization will be challenging.
We do not use arthroscopy cannulas, thereby avoiding the infiltration of fluid and postoperative edema.	When using an iliac crest autograft, there can be pain at the bone block donor site.
The transinterval approach facilitates visibility and the placement of the bone graft.	Performing the double-loop suture can be complex initially because the threads can be confusing.
The dynamic anterior stabilization technique provides anterior support for patients with instability, hyperlaxity, and anterior tissue deficits.	There is a risk of injury to the suprascapular nerve in the spinoglenoid notch and potential injury to the axillary nerve.

Patient Position and Surgical Technique

The surgical procedure is performed with the patient under general and interscalene block. The patient is placed in the beach-chair position with the arm parallel to the body, and no traction is used.

Step 1: Iliac Bone Graft

From the ipsilateral anterior third of the iliac crest, a tricortical bone graft is harvested. After a 4-cm skin incision and split of the subcutaneous tissue, the

Table 3. Advantages and Disadvantages of Using the Anterior Arthroscopic Approach for Multidirectional Shoulder Instability With the Posterior Bone Block, Dynamic Anterior Stabilization, and Modified McLaughlin Technique

Advantages	Disadvantages
You can have a good and global vision of the shoulder using the anterior approach through the rotator interval.	The main limitation of this technique is its high complexity. It is necessary to be an expert shoulder arthroscopist to be able to perform it reproducibly and safely.
A complex pathology that can be treated by arthroscopy.	
The long head of the biceps can be used to give anterior stability.	

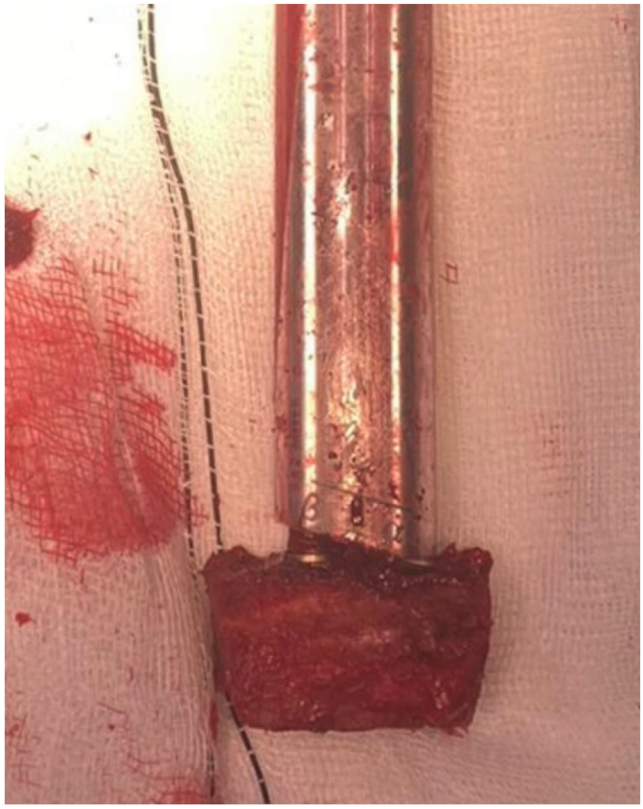

Fig 1. From the ipsilateral anterior third of the iliac crest, a tricortical bone graft is harvested. After a 4-cm skin incision and split of the subcutaneous tissue, the inserting muscles are dissected from the iliac crest and 2.5 to 3 cm of bone is marked. Using the open and arthroscopic coracoid transfer and bone block procedures (Bristow-Latarjet Shoulder Instability System; DePuy Mitek),[7] two 1.5-mm parallel Kirschner wires (K-wires) are inserted through the superior cortex with a specific drill guide. Then, both K-wires are overdrilled with a step drill. After that, the graft is cut with an oscillating saw and prepared on a table to a size of 2.5 to 3 × 1 × 1 cm. Two cannulated 3.5-mm screws are used on each hole. Now, the graft is ready for transfer and fixation to the glenoid.

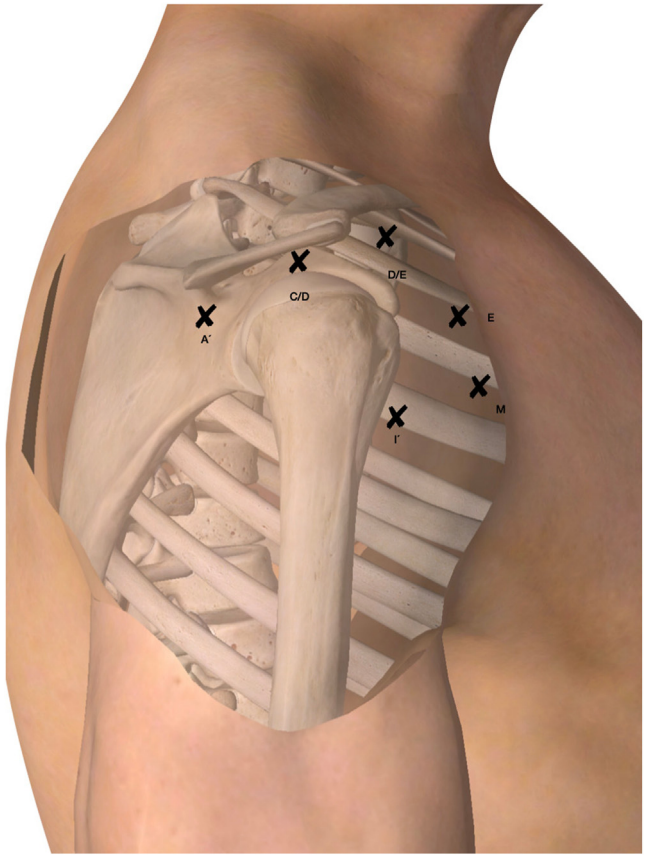

Fig 2. Six portals are used for the hole surgery: (1) D/E portal for arthroscopy instrumentation in opening the rotator interval, long head of the biceps (LHB) and McLaughlin suturing and suture anchor implantation, and direct visualization of the posterior glenohumeral articulation; (2) C/D portal for the arthroscope camera to visualize while opening the rotator interval and having direct visualization of the glenohumeral articulation and subpectoral for retrieving the LHB; (3) A′ portal for bone block fixation into the posterior glena; (4) M portal for retrieving the LHB in the subpectoral space; (5) E portal for opening the subscapular tendon to pass the LHB for dynamic anterior stabilization; and (6) I′ portal for cleaning the subpectoral space before retrieving the LHB.

inserting muscles are dissected from the iliac crest, and 2.5 to 3 cm of bone is marked. Using the open and arthroscopic coracoid transfer and bone block procedures (Fig 1) (Bristow-Latarjet Shoulder Instability System; DePuy Mitek),[5] two 1.5-mm parallel Kirschner wires (K-wires) are inserted through the superior cortex with a specific drill guide. Then, both K-wires are overdrilled with a step drill. After that, the graft is cut with an oscillating saw and prepared on a table to a size of 2.5 to 3 × 1 × 1 cm. Two cannulated 3.5-mm screws are used on each hole. Now, the graft is ready for transfer and fixation to the glenoid.

Step 2: Anterior Arthroscopic Approach

Portals (Fig 2) C/D and D/E, according to the nomenclature by Lafosse and Boyle,[5] are done. A 30° arthroscope is used for the whole procedure. Subacromial bursectomy and cleaning of the entire rotator interval are done with a shaver and radiofrequency (Fig 3) so that diagnostic arthroscopy through the anterior shoulder approach can be achieved.[6-8]

The posterior glenoid space is accessed through the rotator interval to create the A′ portal (Fig 4). The area for the graft placement is prepared, taking care of the suprascapular nerve injury. Subsequently, the size of the glenoid defect is measured (Fig 5).

Step 3: Posterior Bone Block With Iliac Crest Autograft

The incision of the third portal (A′) is extended to allow the passage of the graft. The graft, attached to

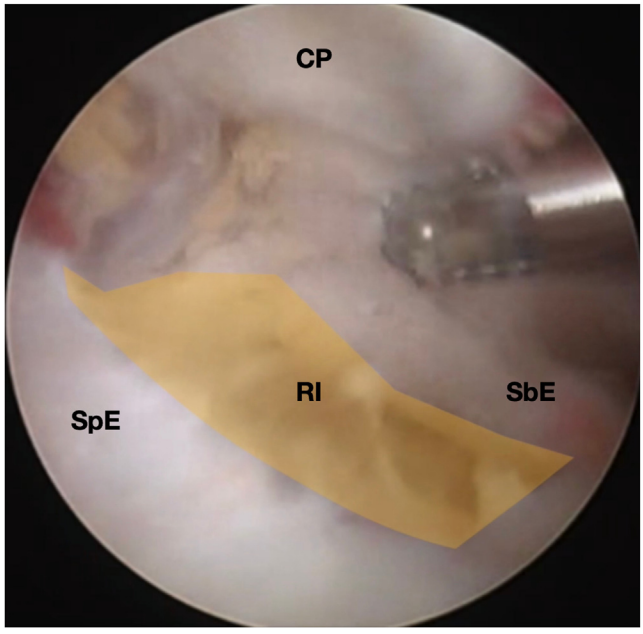

Fig 3. Right shoulder. Beach-chair position. View from the C/D portal and using a shaver from the D/E portal to open the rotator interval (yellow section). (CP, coracoid process; RI, rotator interval; SbE, subscapular; SpE, supraspinatus.)

the DePuy Mitek system, is introduced, and under arthroscopic guidance, it is positioned as desired. It is secured with 2 K-wires and fixed with two 3.5-mm partially threaded cannulated screws (Fig 6). The correction of the posterior glenoid defect is then observed.

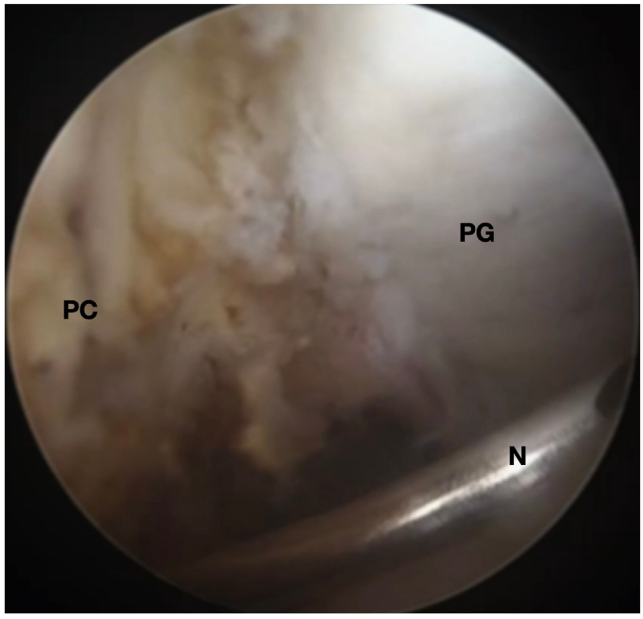

Fig 4. Right shoulder. Beach-chair position. Arthroscopic view from the C/D portal for A′ portal opening using direct visualization. (N, needle PC, posterior capsule; PG, posterior glena.)

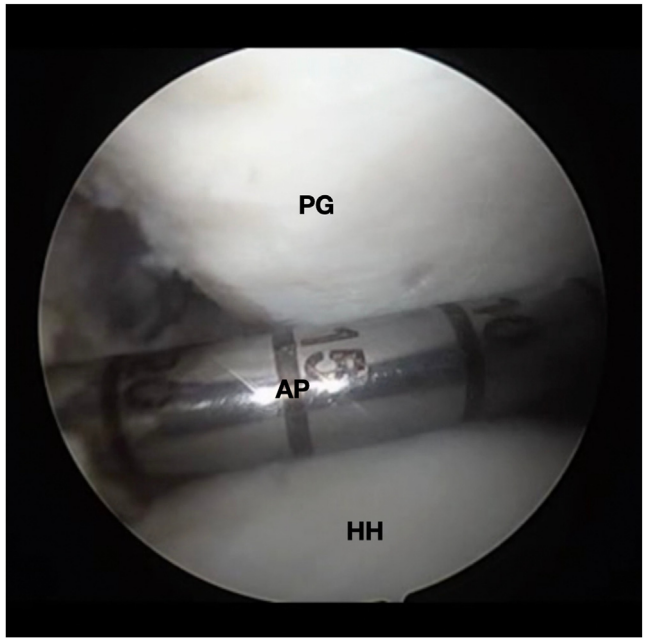

Fig 5. Right shoulder. Beach-chair position. Arthroscopic measurement of posterior glenoid defect. View from the C/D portal and arthroscopic probe for measurement introduced from the A′ portal. (AP, arthroscopic probe; HH, humeral head; PG, posterior glena.)

Step 4: Dynamic Anterior Stabilization

Subsequently, the long head of the biceps (LHB) tendon is sutured using a double-loop suture technique with the E portal (Fig 7). The LHB tenotomy is performed with radiofrequency (Fig 8) for the DAS

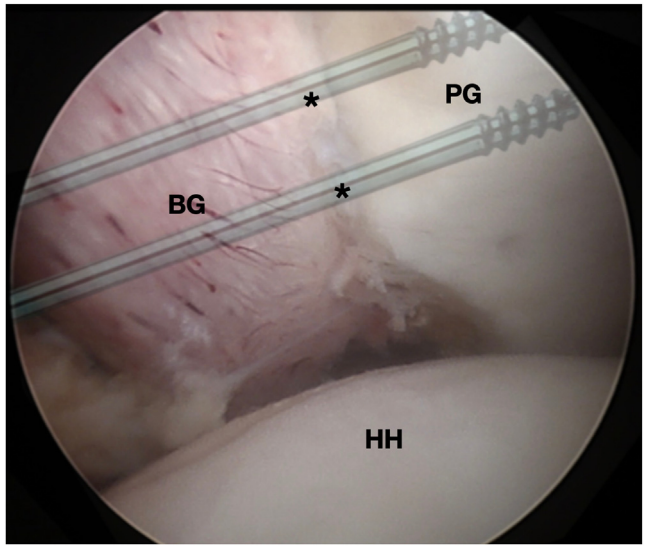

Fig 6. Right shoulder. Beach-chair position. Posterior bone block introduced through the extended A′ portal. A good view can be obtained from the C/D or D/E portals of the correct position of the graft. A schematic draw of the 2 cannulated screws (*) to fix the graft is demonstrated. (BG, bone graft; HH, humeral head; PG, posterior glena.)

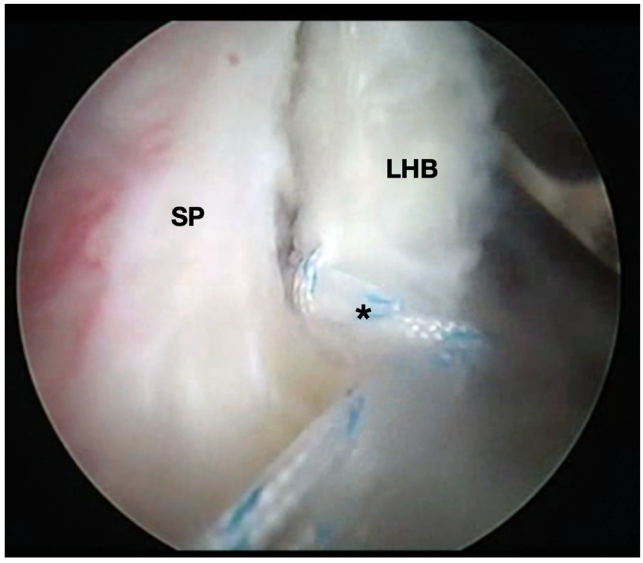

Fig 7. Right shoulder. Beach-chair position. Double lasso loop suture (*) made to the long head of the biceps. View from the C/D portal, instrumentation from the E portal, and suture retrieval from the lateral portal (D/E). (LHB, long head of the biceps; SpE, supraspinatus.)

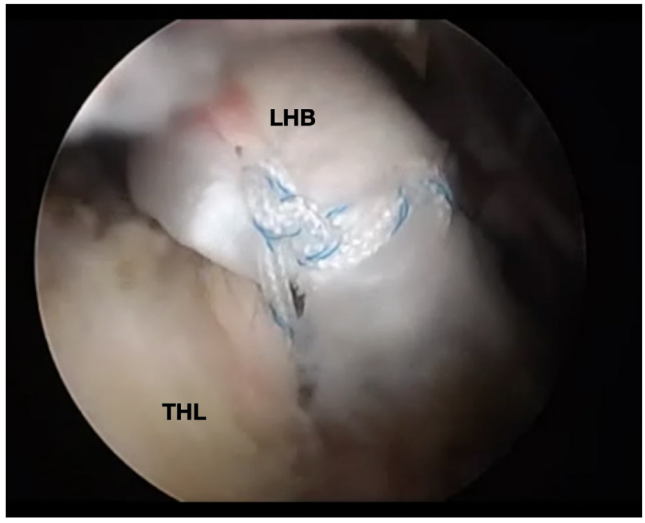

Fig 9. Right shoulder. Beach-chair position. Retrieval of the long head of the biceps in the subpectoral space. View from the C/D portal and instrumentation and retrieval of sutures in the long head of the biceps from the M portal. (LHB, long head of the biceps; THL, transverse humeral ligament.)

procedure, as described by Collin and Lädermann.[9] Following the tenotomy, portal I′ is made to clean the subpectoral space and to create the M portal under direct vision. The LHB is retrieved in the subpectoral space through the M portal (Fig 9) and then transferred through the subscapular space through the E portal (Fig 10). Then, the anterior rim of the glenoid is reattached using a 3.9-mm Omega (Stryker) knotless bone anchor at the cephalic edge and a 1.4-mm Iconix caudal anchor (Stryker) to suture the LHB using a simple loop technique (Fig 11). This achieves the "sling effect" (Fig 12).[10,11]

Step 5: Modified McLaughlin Procedure

Through the lateral portal, the reverse Hill-Sachs lesion is observed. The area is debrided using radiofrequency. Through the anterolateral portal, a 2.3-mm

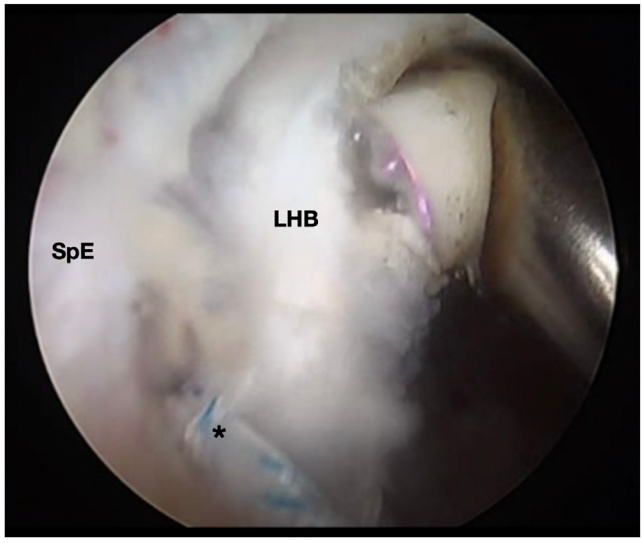

Fig 8. Right shoulder. Beach-chair position. Tenotomy of the long head of the biceps with radiofrequency. View from the C/D portal and instrumentation from the E portal. (LHB, long head of the biceps; SpE, supraspinatus muscle.)

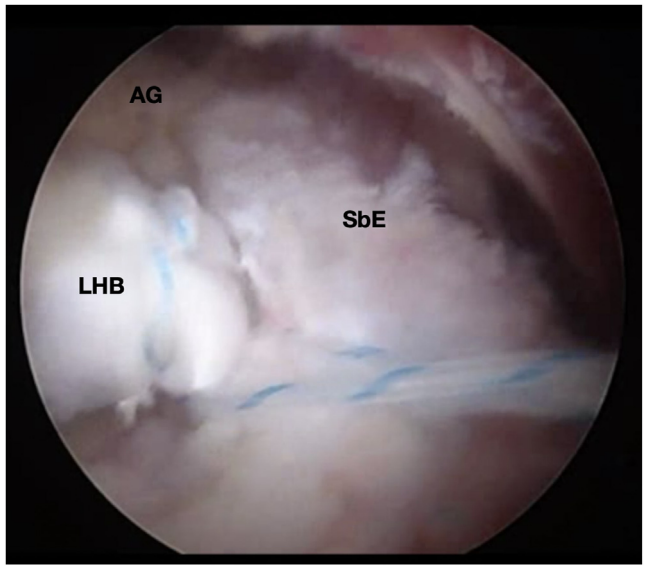

Fig 10. Right shoulder. Beach-chair position. Pass of the long head of the biceps through the subscapular muscle. View from the C/D portal and instrumentation and retrieval of sutures in the long head of the biceps from the E portal. (AG, anterior glena; LHB, long head of the biceps; SbE, subscapular muscle.)

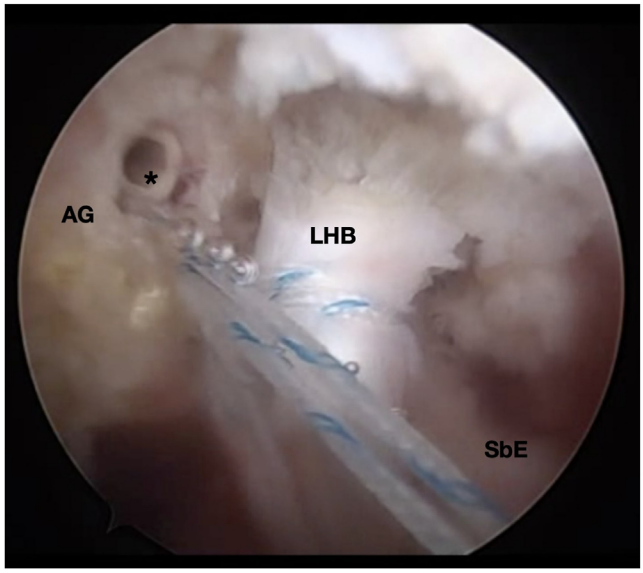

Fig 11. Right shoulder. Beach-chair position. First suture anchor (*) (ReelX; Stryker) for dynamic anterior stabilization. View from the C/D portal and instrumentation from the E portal. (AG, anterior glena; LHB, long head of the biceps; SbE, subscapular muscle.)

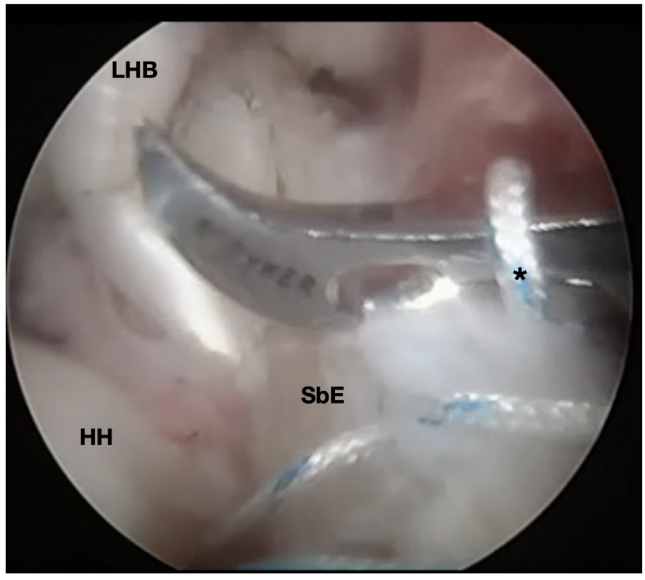

Fig 13. Right shoulder. Beach-chair position. Modified McLaughlin technique suturing the subscapular tendon to the humeral head using an anchor (*) (Iconix Speed; Stryker). View from the C/D portal and instrumentation from the D/E portal. (HH, humeral head; LHB, long head of the biceps; SbE, subscapular muscle.)

Iconix Speeds (Stryker) bone anchor is placed in the defect area. The proximal portion of the subscapularis tendon is sutured using a double-loop technique through the E portal (Fig 13). This way, the humeral head defect is filled with the subscapularis tendon.[12] Final results of DAS and McLaughlin procedures are demonstrated in Figure 14, and final result of the posterior bone block is shown in Figure 15.

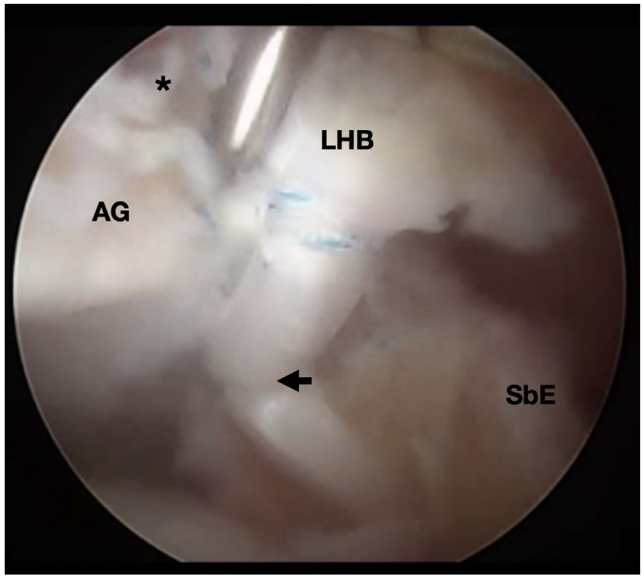

Fig 12. Right shoulder. Beach-chair position. Second suture anchor (arrow) (Iconix Speed; Stryker) for dynamic anterior stabilization. View from the C/D portal and instrumentation from the E portal. The asterisk indicates the first anchor. (AG, anterior glena; LHB, long head of the biceps; SbE, subscapular muscle.)

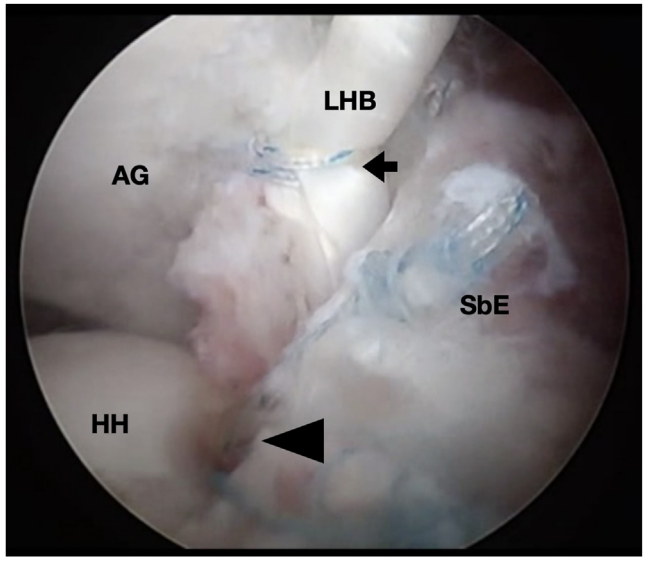

Fig 14. Right shoulder. Beach-chair position. Final result of dynamic anterior stabilization (arrow) and McLaughlin (arrowhead) techniques for anterior instability. View from the C/D portal. (AG, anterior glena; HH, humeral head; LHB, long head of the biceps; SbE, subscapular muscle.)

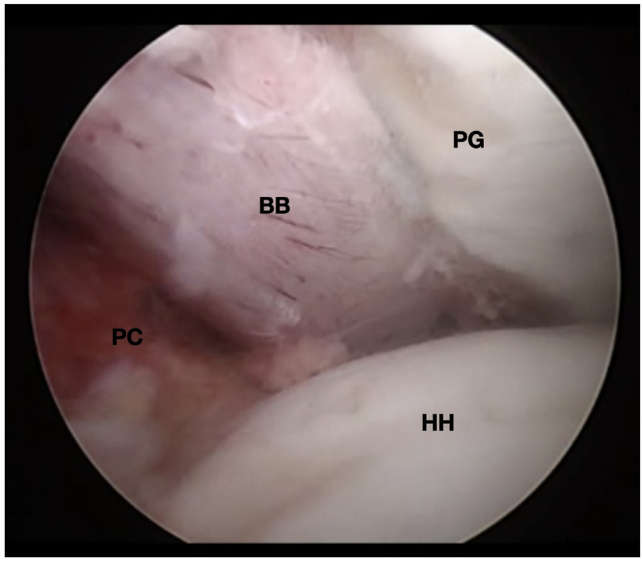

Fig 15. Right shoulder. Beach-chair position. Final result of posterior bone block for posterior instability. View from the C/D portal. (BG, bone graft; HH, humeral head; PC, posterior capsule; PG, posterior glena.)

Rehabilitation

The patient must wear a sling for 3 weeks, which can be removed for eating and grooming. Three weeks after surgery, rehabilitation is started. Passive and self-assisted exercises are started after 15 days, active exercises after 4 weeks, and stretching and muscle strengthening after 3 months.

Discussion

MSI represents an ongoing challenge for orthopaedic surgeons, and multiple techniques have been described to treat this condition.[1,2] A multitude of treatment options are available for complex cases of MSI occurring in patients with traumatic or atraumatic instability and associated multidirectional hyperlaxity.[12-14]

Cartucho et al.[2] describe techniques ranging from soft tissue surgeries to more aggressive approaches involving bone blocks for managing more severe cases. In patients with connective tissue problems, techniques involving double bone blocks combined with capsular plication have been described.[15]

An initial inadequate diagnosis of MSI can lead to insufficient surgeries, resulting in persistent instability and the need for additional surgical interventions.[1,2,15,16] Furthermore, it has been observed that 80% of failed shoulder instability surgeries are associated with bony loss in the glenoid or humeral head.[2,16] On the other hand, glenoid dysplasia and retroversion have been correlated with posterior labral tears and recurrent atraumatic shoulder instability, which may increase the risk of failure after procedures involving only soft tissues to treat symptomatic glenoid dysplasia.[2,12-14] Therefore, we recommend screening for posterior glenoid dysplasia in all patients undergoing surgery for posteriorly predominant multidirectional instability. Other techniques, such as the McLaughlin procedure, have been described for managing posterior instability in cases presenting a reverse Hill-Sachs lesion.[10,17]

The main advantage of this technique is that multidirectional instability can be treated by arthroscopy. Many surgical techniques can be used and combined in the treatment to reduce the recurrent dislocation rate. The main limitation of this technique is its high complexity. It is necessary to be an expert shoulder arthroscopist to be able to perform it reproducibly and safely.

In conclusion, a complex salvage surgery with multiple procedures is presented for patients with multidirectional instability or hyperlaxity, with an important posterior erosion component (mainly glenoid dysplasia) and loss of the anterior wall in previous surgical procedures to theoretically reduce recurrent dislocation rates. An anterior arthroscopic approach, including posterior bone block, DAS, and modified McLaughlin technique, is described in the present article.

Disclosures

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: G.d.C. is a consultant or advisor for Stryker and DePuy Mitek. All other authors (P.R-M., D.G-M., N.Á-B., F.P-N., S.V.C-N., M.L.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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