MANAGEMENT OF THE FAILED LATARJET PROCEDURE

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RECURRENT ANTERIOR SHOULDER DISLOCATION AFTER THE LATARJET PROCEDURE: A TREATMENT ALGORITHM

INTRODUCTION

Although Bankart repair remains the common procedure to address instability, there are many other different surgical techniques that have been developed, with different indications and rates of recurrent instability. Among these techniques, the Latarjet procedure has demonstrated to be a reliable and safe technique to manage anterior shoulder instability, particularly in cases with significant bone loss. The effectiveness of this procedure is based on the triple blocking effect, consisting of ***1)*** the conjoin tendon acting as a sling on the inferior subscapularis and inferior capsule, ***2)*** increase of the anteroposterior glenoid surface, and ***3)*** the effect of repairing the capsule to the stump of the conjoin tendon [12]. Furthermore, new techniques have been proposed to perform the procedure arthroscopically and specific tools and screws have been developed for this purpose [11, 2]. In spite of these encouraging results, the Latarjet procedure is not devoid of complications, such as mobilization or breakage of the screws, glenohumeral arthrosis, resorption of the bone block, restricted shoulder range of movement, infections, and neurological or vascular lesions, in addition to recurrent postoperative instability [1, 18, 17]. Since Latarjet is a non-anatomic technique subsequent revision surgery can be seriously compromised not only by scar tissue obscuring normal tissue planes, but also by alterations of anatomic stabilizing structures. Furthermore, the number of published studies reporting the results of revision surgery after failed shoulder stabilisation using the Latarjet technique is very scant [3, 7, 13, 21].

The purpose of the study is twofold. The first purpose is to report the results of revision surgery in a series of patients with failed Latarjet procedure suggesting an algorithm to approach this challenging situation; the second purpose is to evaluate the causes of failure after the primary surgery and the type of lesions identified at revision surgery.

MATERIAL AND METHODS

Study group

Eleven consecutive patients (ten men and one woman) diagnosed of anterior shoulder instability, and surgically revised from June 2009 to January 2015 for a failed Latarjet procedure were prospectively evaluated. Latarjet was considered failed if the patient complained of postoperative dislocation, subluxation or subjective apprehension that interfered with activities of daily living. Patients with posterior or multidirectional instability, patients with instability associated to rotator cuff tear and those revised for a failed soft tissue stabilisation or other conditions different from shoulder instability were excluded from this study. The following variables were recorded: gender, affected shoulder and dominance, age of the patient at the time of the Latarjet procedure and at revision surgery, the presence of hiperlaxity, the number and type of previous surgical stabilization procedures performed, the reason why Latarjet was indicated instead of a soft tissue procedure, the nature of the first episode of instability following the Latarjet (traumatic or atraumatic), the time elapsed between the Latarjet procedure and the index revision surgery, the specific revision surgery carried out, the type of lesions observed on the preoperative imaging study as well as those observed at the time of revision surgery, including glenohumeral osteoarthritis. Any complication was also noted. All patients gave informed consent and an institutional review board approved the study.

Surgical techniques

One of three potential revision procedures (coracoid graft repositioning, arthroscopic Eden-Hybinette or extraarticular capsular reinforcement) was carried out based on the pathoanatomic findings on the imaging study or at revision surgery. The senior surgeon (EC) performed all procedures with the patient under combined brachial plexus single shot block and general anaesthesia in the beach-chair position. The arm was placed at a side in adduction and neutral rotation, and seated on a conventional padded armrest with the elbow at 90º of flexion. No traction was used. Preoperative antibiotics were administered. These findings focused on the biologic viability of the coracoid graft, as well as on the quality of the anterior soft tissue capsulolabral complex, and the presence of glenoid or engaging Hill-Sachs bone defects.

1 - Coracoid graft repositioning

In those patients in whom the bone graft was deemed viable (ie with the conjoin tendon insertion preserved, and without any signs of osteolysis), but poorly positioned or avulsed, it was dissected, osteotomized if united, abraded, and repositioned fixed with screws on the anterior glenoid neck through a deltopectoral approach.

2 - Arthroscopic Eden-Hybinette

In the presence of bone defects without a viable coracoid graft a modified arthroscopic Eden-Hybinette procedure was carried out [8, 9]. The modified arthroscopic Eden-Hybinette procedure is performed in the beach-chair position with approximately 45º of inclination of the backrest, to allow adequate access to the bone graft harvest site at the iliac crest.

The arm and the ipsilateral iliac crest are prepared and draped in a sterile fashion. The procedure is performed using the same instruments manufactured by DePuy

Synthes (DePuy Synthes, Warsav, In) for the arthroscopic Latarjet [11]. Standard posterior (A), superolateral (D), antero-superior (E), anterolateral (J) and antero-medial (M) portals are created following the same landmarks as described by Lafosse *et al.* for the arthroscopic Latarjet [11]. A diagnostic arthroscopy is performed through a standard posterior portal, and the rotator interval is fully opened through the anterosuperior (E) portal. Once the diagnosis is confirmed the tricortical bone graft is harvested from the ipsilateral anterior iliac crest according to Schwartz DG *et al.* (2013). After the graft has been harvested, it is attached to the double-barrel cannula with the use of two long cannulated screws, creating a single unit that can be manipulated to drive the graft into the glenohumeral joint to its final position. The cortical aspect of the graft should be in contact with the transporting double barrel cannula. The position of the graft was checked to ensure that it was lying flush with the glenoid articular surface and, that there was no lateral overhang.

The anterior capsulolabral tissue is preserved and once the graft is fixed in place, it is repositioned anatomically, leaving the bone block in an extraarticular position. For that purpose the anterior capsulolabral tissue is carefully dissected from the posterior aspect of the subscapularis, detached from the anterior glenoid rim from 1 or 11 to 6 hr positions and later retracted inferiorly to the axillary pouch to allow free access to the anterior glenoid neck. Concomitant lesions such as rotator cuff tears, long biceps head tendon pathologies, and capsulolabral lesions should be preferably addressed after the graft has been fixed to avoid additional soft-tissue swelling. The scope is now moved to the superolateral portal (D) to define the anterolateral portal (J). Using a switching stick the scope is then transferred to the anterolateral portal (J), and the anterior aspect of the subscapularis muscle, and the whole joint cavity through the rotator interval can be evaluated thoroughly. Theoretically, the subscapularis split should have been already established in the previous Latarjet procedure. However, a switching stick can be introduced through the posterior portal parallel to the glenoid surface and passed through the fibers of the subscapularis tendon if the level of the subscapularis split needs to be newly created or widened. Because the direction of the switching stick is in line with the brachial plexus, it is essential that the surgeon pay close attention to the manipulation of the tip and interrupting the passage once it is visualized anterior to the subscapularis fibers. If the split needs to be reoriented o newly created, the M medial portal is created and an ablation diathermy probe inserted to proceed with the subscapularis split in an outside-in fashion. Since the conjoin tendon was removed in the previous Latarjet care should be taken to identify the axillary nerve and avoid any damage of the brachial plexus. Placing the shoulder in adduction and external rotation will help to place the subscapularis fibers away of the nerves. Previous Latarjet screws are removed only if interfered with the position of the iliac crest graft or with the movement of the humeral head by inserting a screwdriver through the M inferiomedial portal.

Visualizing with the arthroscope inserted through the anterolateral D portal, both subscapuris muscular folds are retracted by Wissinger rods inserted through the posterior portal (A) - inferior fold - and the anterolateral (J) portal - superior fold -. Once the anterior glenoid rim has been abraded with a burr until bone bleeding is exposed with a flat surface, the graft is driven into the joint and placed flush with the joint surface. Since the cortical aspect of the graft is in contact with the double barrel cannula, the cancellous bleeding aspect is placed against the abraded glenoid neck. Once the it is confirmed that the position of the graft is adequate, two long K-wires are passed anterior to posterior until they exit through the skin over the infraspinatus fossa, and two tunnels are drilled in the glenoid 3.5-mm partially threaded screws are inserted over the K-wires. Once the 2 screws have been inserted and the K-wires removed, the final position is checked. Any prominence of the graft can be trimmed with the burr.

After the graft has been fixed, the capsulolabral soft tissue is reduced back to its anatomical position, and fixed using anchors following a conventional Bankart repair using anchors. Since the labral ring was disrupted to be retracted inferiorly the most superior part of the labrum where it was sectioned should be placed first. Two to three anchors are usually enough to fix the labrum. Care must be taken not to place the anchors on the way of the screws.

Extraarticular capsular reinforcement

For those cases with postoperative instability and without significant bone defects an extraarticular capsular reinforcement following a modification of the technique described by Sanchez *et al.* was performed. The rationale of the technique is the reinforcement of the anatomical anteroinferior glenohumeral ligament with the synthetic tendon allograft that acts as a restraint, preventing anteroinferior subluxation and dislocation of the humeral head. The mesh structure of the ligament recruits a large fibrous growth reinforcing the inferior glenohumeral ligament. Since the ligament crosses the subscapularis, it increases the tension of the muscle in the position of abduction and external rotation contributing to shoulder stability.

As in the technique described by Sánchez *et al.* [16] the glenohumeral complex is detached of the anterior glenoid rim at the insertion of the anteroinferior glenohumeral ligament with a periostal elevator or a radiofrequency probe inserted through a rotator interval anterosuperior portal while visualizing from a conventional posterior or superolateral portal. Using an extrarticular a 4mm diameter tunnel is drilled through the scapular neck at the level of the insertion of the anterior glenohumeral ligament. The synthetic ligament is passed through this tunnel until visulized with the arthroscope in the gap between the anterior glenoid rim and the capsulolabral complex, and is firmly attached by a toggle that is seated flush to the posterior capsular neck. In the original technique a miniopen deltopectoral approach is created to recover the anterior end of the ligament, and to attach it firmly with a staple to the humeral neck at the inferior edge of the subscapularis. The adequate tension of the ligament is judged by moving the patient's arm position in abduction and external rotation. Allograft isquiotibialis can alternatively used instead of the synthetic ligament. In the modification here proposed, the ligament is arthroscopically attached to the humeral neck with interference Swivelock biceps tenodesis screw (Arthrex, Naples, Fl). For this purpose two additional portals substituting the deltopectoral approach are created. One portal to visualize the entire anterior subscapularis is created at the most inferior deltopectoral crease, while just anterior to the humeral neck at the level of the inferior edge of the lesser tuberosity is later created to prepare the bone tunnel and to fix the graft.

Rehabilitation protocol

Concerning postoperative management, active and passive elbow and wrist mobility is permitted from the early postoperative period. Patients are immobilized in a conventional sling with the arm in internal rotation for four weeks. The sling can be removed 3 to 4 times daily during 30min. Active and passive motion is permitted, but external rotation and abduction are not allowed until 6 weeks after surgery. The same postoperative program was followed for all patients irrespective of the technique used. Rehabilitation with a physical therapist was started at the 6^{th} postoperative week.

Clinical assessment

Patients were clinically reviewed with a minimum of 1 year of follow-up. The objective evaluation of the procedure was determined according to the rating systems of Rowe *et al.* [15], subjective shoulder value (SSV), and to the recurrence of instability. Range of movement was measured using a goniometer with the patient in the seating position, and the external lag measured with arm at a side and with the shoulder at 90º of abduction. The subjective shoulder value was noted. Recurrence was defined as a subluxation or a dislocation after surgery, whereas a positive apprehension sign only did not indicate a clinical failure if the shoulder was otherwise subjectively stable and not interfering with daily activities.

Imaging study

Anterior-posterior and scapular Y X-ray views were obtained preoperatively and immediately after surgery in all patients. Preoperatively, all patients were studied with computed tomography (CT). Postoperatively CT scan obtained at 6 months, and on a yearly basis also evaluated patients undergoing revision with bone block repositioning or with a modified arthroscopic Eden-Hybinette. The analysis focussed on the quality of the bone block's healing and its position, and on the presence of osteoarthritis. The bone block was considered healed if bone bridging was seen between the graft and the glenoid in addition to the abscense of radiolucencies. The position of the bone block was evaluated in the axial and sagittal planes. In the sagittal plane the position of the graft was considered satisfactory if at least two thirds of the graft were located inferior to the equator of the glenoid surface. In accordance with Boileau *et al.* we assumed that the accurate position of the bone block would be reached when "flush" onto (or aligned with) the virtual straight line within a medialized value of 5mm or a lateralized value of 3mm.

RESULTS

The mean age at the time of the primary Latarjet procedure was 33,9 years (range, 17 to 56 years) and was 35,9 years (range, 18 to 59 years) at the time of the revision procedure. The time elapsed between Latarjet and revision surgery was 21,2 months (range, 1 to 97 months). In 7 patients the left shoulder was affected and the right in 4. The dominant was involved in 7 patients. None had bilateral instability. Initial dislocation was traumatic in all cases. The senior author had carried out the Latarjet procedure arthroscopically in 8 patients following the technique described by Lafosse *et al.*, while 3 were operated and though conventional delto-pectoral approach -one by the senior author, and two somewhere else's-. The average follow-up was 44,3 months (range, 14 to 127) months from the initial Latarjet procedure, and 21 months (range, 12 to 33 months) from the time of the last revision surgery.

The indication for Latarjet was the presence of a bony Bankart in 4 cases, and a failed previous Bankart repair in 6. One additional patient with hiperlaxity and a Bankart lesion requested to undergo an arthroscopic Latarjet because his twin brother had been successfully revised with an arthroscopic Latarjet after a failed Bankart repair. The indication for revision Latarjet surgery was postoperative recurrent dislocation in all cases. Six patients participated in overhead or contact sports.

When failures were analysed, at least one potential cause of failure was identified in all patients. Four patients showed two potential causes of failure. The graft was deemed to be malpositioned in 4 cases (too medial and superior in three and too inferior in one), avulsed in 3, and 2 patients showed osteolysis of the graft. Five patients showed clear signs of capsular hiperlaxity, in one patient the capsulolabral tissue was absent and the graft partial resorbed leaving the screws exposed. A large off-track engaging Hill-Sachs lesion could contribute to instability in three cases. With regard to Latarjet revision surgery, 3 patients underwent bone graft repositioning, 7 arthroscopic extraarticular anteroinferior ligament reinforcement, and 2 an arthroscopic Eden-Hybinette procedure. Three of the patients initially managed with ligament reinforcement had severe bone defects in the glenoid and needed to be revised again due to persistent instability. An arthroscopic Eden-Hybinette was carried out with a satisfactory outcome. Three patients required removal of the screws.

Concerning the clinical results, Rowe scored increased from 43,1 (range, 25 to 45) points preoperatively to 85,7 (range, 60 to 100) points postoperatively (p<0,005). The mean subjectively shoulder value after surgery was 82,5 points, (range 60 to 100). All patients remained stable after revision surgery, except one who reported subluxations after an arthroscopic Eden-Hybinette. Four patients reported apprehension in the position of abduction and external rotation that did not interfere with daily activities. Range of movement was satisfactory preserved after Latarjet revision surgery, but the mean external rotation lag with the arm at a side was 25º, whereas it was 22º with the arm at 90º of abduction.

At the latest follow all iliac crest grafts showed signs of union in all except one case that did not otherwise showed signs of osteolysis. The position of the graft was considered satisfactory in the patients undergoing arthroscopic Eden Hybinette procedure. One patient who showed instability after failed Latarjet was managed with extraarticular capsular reinforcement, and required a second revision surgery consisting of an arthroscopic modified Eden-Hybinette showed stiffness and shoulder pain postoperatively. Postoperative CT scans showed erosion on the anterior aspect of the articular surface, and underwent partial resurfacing with a Partial Eclipse prosthesis (Arthrex, Naples, Fl) with satisfactory outcome. Patients had neither neurovascular complications nor discomfort related to the iliac crest donor site scar.

DISCUSSION

The number of reports of series of patients surgically revised for a failed Latarjet procedure is very limited [3, 7, 13, 14, 21], and therefore there are no clear recommendations on how to deal with patients under these circumstances.

Since Latarjet restores the glenoid surface, it is especially recommended in patients with shoulder instability and glenoid bone defects. To be effective in re-establishing shoulder stability several authors have underlined the importance of achieving an adequate bone graft positioning [4, 6]. The ideal position of the graft is flush with the articular surface in the axial plane and below the equator of the glenoid in the sagittal plane. The possibility of repositioning a viable but mispositioned graft in patients with a failed Latarjet had never been considered. In this study the graft could be successfully repositioned in patients with a viable coracoid graft.

In addition, new strategies need to be explored in patients with a failed Latarjet with significant glenoid defects when the graft is disappeared or has a suboptimal quality to be repositioned. A series from Lunn et al reported the clinical and radiographic results of 34 shoulders with the modified Eden-Hybinette operation as a salvage procedure after failure of an index Latarjet at a long-term follow-up [13]. Good or excellent results were recorded in 27 of the 34 patients (79%), with a moderate rate of osteoarthritis, and a satisfactory 68% rate of patients able to return to preinjury sporting activity. In this chapter a new modified technique here described to perform the Eden-Hybinette procedure arthroscopically. The instruments developed by Lafosse *et al.* for the technique of arthroscopic Latarjet can be used effectively for this purpose [11].

Several authors have noted hyperlaxity to be common in patients presenting after failure of their primary surgery, with rates of 46% and 59% [20, 5]. The reports on the use of soft-tissue procedures for revision Latarjet stabilization are more common. These procedures usually not only address the Bankart lesion, but also manage capsular hiperlaxity with capsular plication. Young *et al.* reported 10 satisfactory results (75%) in a series of 15 patients managed with capsular shift after a failed Bristow procedure [21]. Meeham and Peteresn (2005) included 6 Bristow procedures in the 28 failed index operations for which they did revision surgery consisting of Bankart repair plus capsular shift. They had an overall 84% satisfactory rating, with 2 (7%) recurrent instability, but 2 out of 6 patients in whom a previous Bristow operation had been performed failed. Boileau *et al.* reported the results of the same revision technique in a population of 22 patients that included 19 failed Latarjet [3]. The satisfactory results following the Rowe and Walch-Duplay scales were 67% and 85% respectively. Interestingly, the authors underlined the importance of a preoperative imaging study with CT scan to evaluate the position of the graft, but did not considered the possibility of repositioning the graft when necessary. Five out of the eleven patients of this series showed signs of capsular hiperlaxity. The initial purpose of the technique of extra-articular capsular reinforcement described by Sánchez *et al.* [16] was to address capsular hiperlaxity. The procedure was carried in seven patients of the series here reported. Interestingly, it was effective in stabilising the shoulder in 4 of these patients, while in those with bone glenoid defects the technique failed and patients had to be revised with a modified arthroscopic Eden-Hybinette technique. Development of osteoarthritis has been described after procedures involving transfer of an iliac crest graft to the anterior glenoid rim [13], and extraarticular capsular reinforcement might overcome this complication.

This study has a number of important limitations: it is a retrospective investigation, the sample of patients is small, and consists of an heterogeneous group of patients treated with a wide variety of joint lesions managed with different methods. However, for the first time it suggests an algorithm to approach patients in whom a Latarjet procedure has failed, including new arthroscopic techniques that could be helpful for this and other difficult situations in glenohumeral instability.

In summary, the management of failed Latarjet needs to be tailored to each patient depending on the specific abnormalities identified in the shoulder. Patients with capsular hiperlaxity and no bone defects can be managed efficiently with extraarticular capsular reinforcement. Nonetheless, glenoid bone defects should be reconstructed if present. The coracoid graft can be used for this purpose if it is viable and malpositioned, but iliac crest graft seems to be advisable if the coracoid graft cannot be used for that purpose.

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