Arthroscopic Iliac Crest Bone Allograft Combined With Subscapularis Upper-Third Tenodesis Shows a Low Recurrence Rate in the Treatment of Recurrent Anterior Shoulder Instability Associated With Critical Bone Loss

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Purpose: To evaluate the clinical and radiologic outcomes of patients undergoing arthroscopic glenoid bone allograft combined with subscapularis upper-third tenodesis for anterior shoulder instability associated with clinically relevant bone loss and hyperlaxity. **Methods:** Between January 2016 and December 2017, patients with recurrent anterior shoulder instability associated with bone loss and hyperlaxity were selected and treated with arthroscopic iliac crest bone graft combined with subscapularis upper-third tenodesis. The selection criteria were as follows: more than 5 dislocations; positive apprehension, anterior drawer, and Coudane-Walch test results; glenoid bone defect between 15% and 30% and humeral bone defect with an engaging Hill-Sachs lesion; and no previous shoulder surgery. All patients were followed up with the Constant score, University of California—Los Angeles (UCLA) rating, Rowe score, and visual analog scale evaluation. Assessments were performed with plain radiographs and a PICO computed tomography scan before surgery and at 2 years of follow-up. **Results:** Nineteen patients were included in the study, with a mean follow-up duration of 34.6 months (range, 24-48 months). In 17 patients (89%), excellent clinical results were recorded according to the Rowe score. The Constant score improved from 82.9 (standard deviation [SD], 5.2) to 88.9 (SD, 4.3) ($P = .002$); Rowe score, from 25.3 (SD, 5.3) to 89.1 (SD, 21.8) ($P < .001$); UCLA score, from 23.7 (SD, 3) to 31.5 (SD, 4.8) ($P < .001$); and visual analog scale score, from 3.2 to 1.3 ($P < .001$). Patients met the minimal clinically important difference 94.7%, 89.5%, and 47.3% of the time for the Rowe score, UCLA score, and Constant score, respectively. Bone graft resorption was observed in all patients: partial in 9 and complete in 10. We recorded 2 recurrent traumatic dislocations (11%), with no case of persistent anterior apprehension or other complication. **Conclusions:** An arthroscopic glenoid bone graft combined with subscapularis upper-third tenodesis may be a valid surgical option to treat recurrent anterior instability associated with both bone loss and hyperlaxity. **Level of Evidence:** Level IV, case series.

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The surgical management of anterior shoulder instability remains controversial.[1-3] Both pathologic factors, such as glenoid bone loss, capsular deficiency, and the anatomic localization and morphology of Hill-Sachs lesions, and patient factors, such as age, the type and level of sport, and joint laxity, have been identified as critical points to be considered in the selection of the surgical indication.[4-8]

A 10-year follow-up of arthroscopic Bankart repair showed a failure rate greater than 30%, not only in patients with glenoid defects of 25% but also in those with moderate bone loss, especially athletic patients and those with hyperlaxity.[9] To improve the results of the arthroscopic Bankart procedure, different authors modified the technique by using different sutures or anchor configurations, adding Hill-Sachs remplissage or subscapularis tenodesis.[10,11]

At the same time, the Latarjet procedure has regained popularity also owing to the introduction of the arthroscopic technique, even though it is still associated with a high rate of complications and a long learning curve.[12-14] Consequently, in recent years, we have moved from a choice between 2 single procedures—arthroscopic Bankart and open Latarjet procedures—to a multitude of surgical options.

To treat both glenoid bone loss and hyperlaxity, we have introduced an all-arthroscopic surgical procedure combining a free frozen iliac crest glenoid bone graft, Bankart repair, and subscapularis upper-third tenodesis. The theoretical aim of this procedure would be to keep the failure rate in these high-risk patients as close as possible to that of the Latarjet procedure, reducing the complications associated with open or arthroscopic coracoid transfer. Our purpose was to evaluate the clinical and radiologic outcomes of patients undergoing arthroscopic glenoid bone allograft combined with subscapularis upper-third tenodesis ("ASA graft") for complex anterior shoulder instability. We hypothesized that ASA graft would reduce the failure rate of the arthroscopic procedure for shoulder instability associated with clinically relevant bone loss and hyperlaxity, thereby maintaining a low complication rate and a reasonable learning curve.

Methods

This was a retrospective review of prospectively collected data from 2 shoulder units in 2 different hospitals. Institutional review board approval was previously obtained for arthroscopic subscapularis upper-third tenodesis surgery (No. 229/CE 1−20 Oss). The specific amount of glenoid bone loss that we usually consider as an indication for this procedure is 10%; however, in this study, we preferred to include only patients with glenoid bone loss greater than 15% to specifically select a group of patients with a high risk of failure. Between January 2016 and December 2017, patients affected by recurrent anterior shoulder instability associated with bone loss and hyperlaxity were selected to be treated with ASA graft. The selection criteria were as follows: more than 5 anterior shoulder dislocations; positive findings of the apprehension test and anterior drawer test on physical examination; shoulder hyperlaxity, measured as external rotation at the side greater than 85° in both shoulders (Coudane-Walch test); the presence of a glenoid bone defect between 15% and 30% and a humeral bone defect with an engaging Hill-Sachs lesion ascertained intraoperatively; and no previous shoulder surgery. The exclusion criteria were as follows: posterior or multidirectional instability, acute glenoid fracture, presence of neurologic symptoms, rotator cuff tear, pre-existing glenohumeral osteoarthritis, previous shoulder surgery, and overhead-throwing sports activities that require external rotation in abduction greater than 90°. All the surgical procedures were performed by 2 skilled arthroscopic surgeons (R.R. and M.M.).

Preoperative Assessment

Clinical examination was performed on admission, including the Constant score, University of California−Los Angeles (UCLA) score, Rowe score, and visual analog scale (VAS) score. Preoperative plain radiographs and computed tomography (CT) scans with the PICO surface area measurement were obtained to accurately determine the glenoid bone deficit.[15] The preoperative and postoperative types and levels of sport were recorded.

Surgical Technique

The detailed surgical technique was already described and published.[16] The graft was tailored from a frozen iliac crest allograft harvested from 2 different Italian tissue banks. In all cases, the graft size was 20 mm × 9 mm × 9 mm. Two 2.8-mm drill holes were made 10 mm apart and 5 mm from each edge of the graft, and the superior pole (north) and the posterior surface (glenoid) were marked. This size of graft was selected to allow it to slide into a dedicated 15-mm metal cannula. In each hole of the graft, a 6-mm round EndoButton (Smith & Nephew, Andover, MA) was positioned on the anterior side. Arthroscopy was performed using a 30° scope with the patient in a standard lateral decubitus position. After capsule detachment and glenoid neck preparation, with the scope in the anterosuperior portal, a specific aiming device was introduced from the posterior portal to create, at the right glenoid depth and height, 2 glenoid tunnels. Care was taken to introduce the guide parallel to the glenoid surface, perfectly perpendicular to the anterior glenoid neck, and at the center of the glenoid defect (Fig 1A). Once the guide was positioned, two 2.8-mm sleeved drills were placed in each hole of the guide and advanced to the anterior aspect of the glenoid neck. The guide is designed so that the drills are placed 5 mm medially to the glenoid surface, parallel to each other, and 10 mm apart. The inner drill was removed, leaving the cannulated outer sleeve. The anteroinferior portal was enlarged to allow the passage of the 15-mm metallic cannula in the rotator interval. One nonresorbable No. 2 high-fatigue suture (Orthocord; DePuy Mitek, Raynham, MA) was introduced in each sleeve using a flexible looped guidewire from posterior to anterior (Fig 1B). Each Orthocord wire was retrieved using a loop grasper from the anteroinferior portal and passed through the graft.

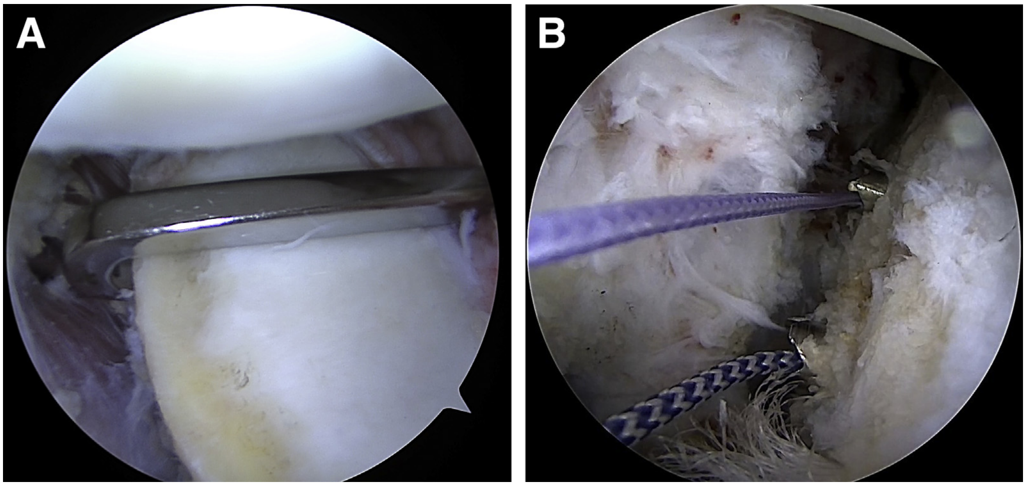

Fig 1. Graft positioning. Right shoulder in lateral decubitus position, viewed from anterosuperior portal. (A) A specific hook guide is inserted from the posterior portal parallel to the glenoid surface. (B) Superior and inferior glenoid sleeves in place with Orthocord wires.

The graft south pole was first passed into the joint, keeping the guidewires in a parallel position, pulling the Orthocord wires from posterior, until the graft was flush with the glenoid anterior neck, with each suture exiting the skin posteriorly (Fig 2). Two posterior EndoButtons were advanced using a sliding knot until they were flush with the posterior face of the glenoid. A suture tensioner device was used to secure the posterior round EndoButtons. The procedure was then completed by repairing the anteroinferior capsule with one 2.9-mm knotless PEEK (polyether ether ketone) anchor, similarly to part of a standard Bankart procedure, at the 5-o'clock position.

After bone graft positioning and Bankart repair, the procedure was completed with a subscapularis upper-third tenodesis (ASA) to allow the subscapularis tendon and the entire anteroinferior capsule to shift from inferior to superior to obtain better coverage of the graft and soft-tissue tensioning. The ASA procedure was already described in previous publications.[11,17] A bone hole was placed on the anterior glenoid edge in an upper position (from the 9- to 10-o'clock position in a left shoulder and from the 2- to 3-o'clock position in a right shoulder), slightly over the top of the glenoid edge, to receive a 2.9-mm knotless anchor. The middle upper third of the subscapularis tendon was penetrated approximately 5 mm from its superior border with a suture-passing device loaded with a tape (UltraTape; Smith & Nephew) slightly flush with the articular surface in the mediolateral position just over the graft (Fig 3A). The free ends of the tape were retrieved, and a loop was created. Both free ends of the tape were passed through the anchor's eyelet, and the anchor was pushed along the tape toward the bone hole (Fig 3B), with the arm being kept in neutral rotation. The advancement of the subscapularis tendon over the graft, effective closure of the anterior pouch, and posterior shifting of the humeral head in the correct position centered on the glenoid socket were clearly visible and could be assessed by arthroscopic examination from the posterior and anterosuperior portals (Fig 4). All patients were treated postoperatively in the same way, using a sling in neutral rotation for 4 weeks, allowing passive elevation for the first few days without pain and limiting external rotation for 6 weeks.

Postoperative Evaluation and Outcome Measurement

A standard postoperative CT scan was obtained in all cases to evaluate graft positioning in both the coronal and axial planes according to Neyton et al.[18] Graft height was measured in the coronal plane as the percentage of the bone block under the 50% line (equator). We considered the placement of the graft too high when less than 20% of the graft was below the equator,

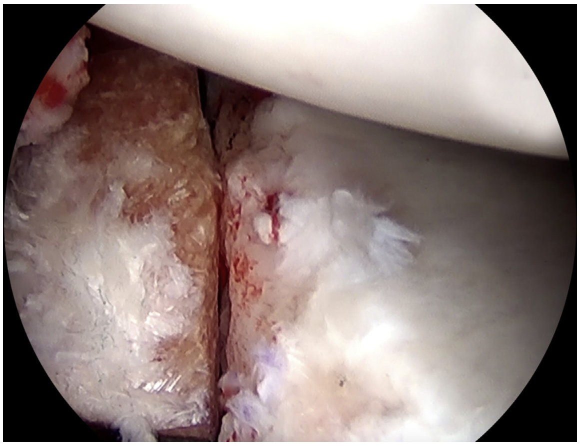

Fig 2. Final positioning of anterior glenoid bone allograft. Right shoulder in lateral decubitus position, viewed from anterosuperior portal.

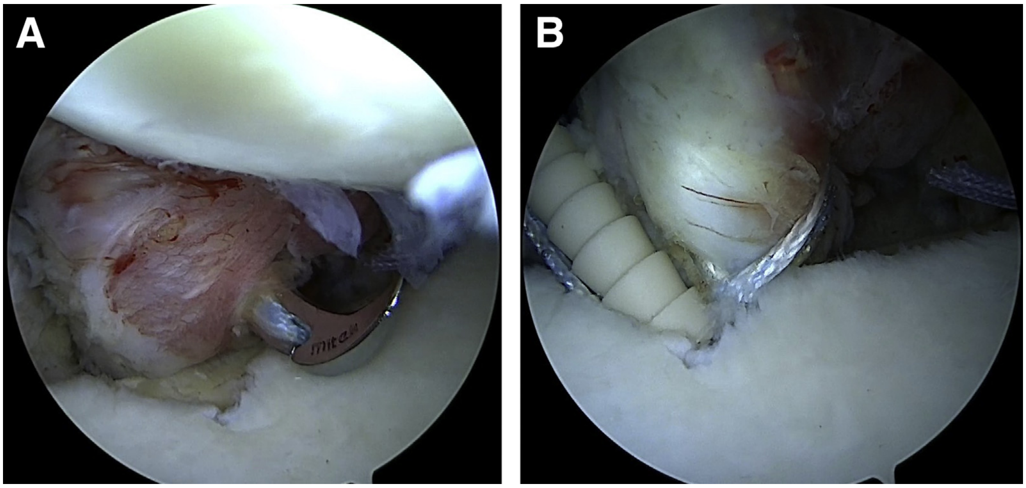

Fig 3. Subscapularis upper-third tenodesis (ASA procedure). Right shoulder in lateral decubitus position, viewed from anterosuperior portal. (A) The middle upper third of the subscapularis tendon is penetrated with a suture-passing device loaded with a tape. (B) Fixation of subscapularis tendon to glenoid with 2.9-mm knotless anchor.

too low if 100% of the graft was under the level of the equator, and good if approximately 50% of the graft was below the equator. The mediolateral positioning of the graft was measured in the axial plane at the upper and inferior hole. The bone block was considered medial if its most lateral aspect was 4 mm medial to the joint line or greater; flush if between +1 and −3 mm; or lateral if greater than 1 mm laterally relative to the joint line. All patients were followed up with the Constant score, UCLA score, Rowe score, and VAS score. The minimal clinically important difference (MCID) cutoff values for the Rowe score have already been established in patients who underwent shoulder surgery for anterior arthroscopic stabilization.[19] For the Constant and UCLA scores, we used the MCID cutoff values obtained from studies evaluating patients who underwent arthroscopic rotator cuff repair.[20,21] At 2 years postoperatively, plain radiographs and CT scans with the PICO method were obtained. In 1 patient, traumatic redislocation occurred 19 months after surgery, and the control radiographs and CT scan were obtained at that point. Bone graft resorption was defined as partial when PICO highlighted a bone defect smaller than the preoperative value or as complete when the bone defect was ±2% of the preoperative value. Data about graft position and resorption were categorized as discrete values. The time of surgery, the length of hospital stay, any recurrences of dislocation and/or subluxation, and any complications were recorded.

Statistical Analysis

Statistical analysis was performed using SPSS software (version 20.0; IBM, Armonk, NY). Data were shown as mean ± standard deviation (SD) or as number (percentage). The values were tested for normal distribution using the Kolmogorov-Smirnov test and the Shapiro-Wilk test. Univariate comparisons of dichotomous data were performed with the use of the χ^2 or Fisher exact test, whereas the *t* test was used to compare group means with SDs. Multiple regression was also used to evaluate the effect of the test variables on the values of the dependent variables. Two-sided *P* values were calculated; the level of significance was defined as $P < .05$.

Results

Clinical Results

Nineteen patients were enrolled, with a mean age of 27.5 years (SD, 5.8 years). Of these patients, 10 (50.8%) had sustained their first dislocation after a low-energy indirect trauma whereas 9 reported a high-energy sports accident. Twelve patients were involved

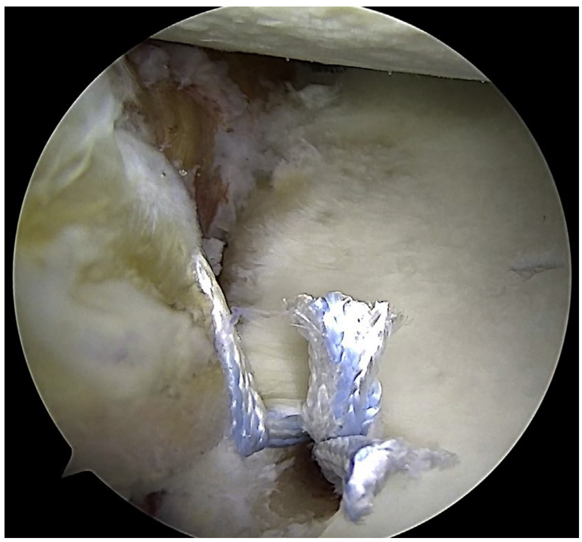

Fig 4. Final arthroscopic result. Right shoulder in lateral decubitus position, viewed from anterosuperior portal. The bone allograft is extra-articular, and it sustains the anterior capsule repair.

in high-risk sports (bodybuilding, karate, soccer, horse riding, acrobatic dance, cycling, and motocross): 4 at a high professional level and 8 at a recreational level. Of the patients, 10 (50.8%) were right hand dominant whereas 9 were left hand dominant. There were 18 men and 1 woman. All arthroscopic intraoperative findings are reported in Table 1. The percentage of preoperative glenoid bone loss was 20% (SD, 3%). The operating time was 88.9 ± 13 minutes, and the average follow-up period was 34.6 months (range, 24-48 months). The average loss of external rotation at final follow-up was 12° with the arm at the side (ER1 position) ($P < .001$) and 5° in abduction (ER2 position) ($P =$ .1). Preoperative and postoperative outcome values are reported in Table 2. Patients met the MCID 94.7%, 89.5%, and 47.3% of the time for the Rowe, UCLA, and Constant scores, respectively. The 12 patients involved in high-level contact sports were able to return to their preoperative level of recreational or professional athletic activity.

We observed 2 failures in patients with a new traumatic anterior dislocation at 19 and 28 months after surgery. In both patients, complete bone graft resorption occurred. Nevertheless, the statistical analysis did not identify any variable associated with postoperative redislocation, including bone graft resorption. Both patients affected by redislocation underwent a reoperation by the same surgeons performing a Latarjet-Patte procedure as described by Patte and Debeyre[22] and Joshi et al.[23] Intraoperative histologic evaluation of the anterior glenoid tissue showed scar tissue with connective extracellular matrix and fibroblasts, whereas no organized bone tissue was detected.

Radiologic Results

In 18 cases, the graft percentage below the glenoid equator was between 40% and 70% and the graft was defined as being in the correct coronal position. In one of the initial cases, the graft was too high, without any clinical consequences at 40 months of follow-up. In the axial plane, all grafts were considered flush, that is, between +1 and −4 mm from the glenoid border. No lateral or medial graft positioning was observed. At 2 years, graft resorption was observed in all patients. Total resorption was observed in 10 patients. Among the other 9 patients (i.e., patients with partial resorption), we observed 7 cases with a negative PICO value smaller than the preoperative value and 2 cases with a positive PICO value (Figs 5-7). Bone graft resorption was not statistically associated with redislocation ($P = .56$). We did not observe any secondary bone graft dislocation or any case of mechanical failure of the fixation system. No osteoarthritis progression, according to Samilson and Prieto,[24] was found on plain radiographs.

Table 1. Arthroscopic Pathologic Findings

Pathologic Finding	n (%)
HAGL lesion	1 (5.2)
ALPSA lesion	14 (73.7)
GLAD lesion	8 (42.1)
SLAP tear	2 (10.5)
Loose bodies	2 (10.5)

ALPSA, anterior labroligamentous periosteal sleeve avulsion; GLAD, glenoid labral articular disruption; HAGL, humeral avulsion of glenohumeral ligament.

Discussion

The most important finding of this study was that arthroscopic implantation of a cryopreserved iliac crest graft, performed through the rotator interval, was possible without any neurovascular risk. Although bone graft resorption was observed in all patients, excellent clinical results according to the Rowe score were obtained in 17 patients (89%), with redislocation in 2 patients. No perioperative complications, such as graft fracture, clinically significant graft malpositioning, or any other events requiring conversion to open surgery, occurred. Compared with the arthroscopic Bankart repair results published in previous studies, ASA graft was able to reduce the failure rate in patients affected by complex shoulder instability.[9] Compared with the arthroscopic Latarjet procedure results published in previous studies, ASA graft showed a lower complication rate and a shorter operating time.[12-14,25] In our study, the average operating time was 88.9 ± 13 minutes, with the last 5 cases requiring, on average, 70 minutes. Leuzinger et al.[26] observed a decrease in the median operating time for the arthroscopic Latarjet procedure from 123.8 minutes to 92.6 minutes after 20 procedures performed by 5 skilled arthroscopic surgeons. The operating time is a matter not just of the time consumed but also of surgical complexity and of the risk of early complications.[27] ASA graft does not require a coracoid osteotomy and subscapularis split; moreover, in our opinion, the positioning of a free graft through the rotator interval is easier than the mobilization of the coracoid with the attached conjoint tendon through a subscapularis split.

The open or arthroscopic Latarjet procedure has the lowest recurrence rate and the highest follow-up time for patients affected by recurrent anterior instability associated with bone loss.[28,29] However, the high complication rate, the long learning curve, the irreversible modification of the coracoacromial arch, the impairment of subscapularis strength, and the morphologic and volumetric variabilities of the coracoid process, as well as its resorption, are all factors well described in the literature.[12-14,25,30,31] We believe that an arthroscopic bone graft offers different theoretical advantages if compared with an open or arthroscopic Latarjet procedure: no muscle damage to the deltoid or subscapularis, a minimal risk of neurovascular

Table 2. Preoperative and Follow-up Clinical Outcomes

	Preoperative	Follow-up	*P* Value for Comparison	% of Patients With MCID
CS	82.9 ± 5.2	88.9 ± 4.3	.002	47.3
UCLA score	23.7 ± 3	31.5 ± 4.8	<.001	89.5
Rowe score	25.3 ± 5.3	89.1 ± 21.8	<.001	94.7
VAS score	3.2 ± 1.3	1.3 ± 1.2	<.001	
Passive ER1	93° ± 3.5°	81° ± 5°	<.001	
Passive ER2	95° ± 8.8°	90° ± 9.1°	.1	

NOTE. Data are presented as mean ± standard deviation unless otherwise indicated.

CS, Constant score; ER1, external rotation with arm in adduction; ER2, external rotation with arm in abduction; MCID, minimal clinically important difference; UCLA, University California—Los Angeles; VAS, visual analog scale.

complications, no use of screws with the risk of excessive angulation and secondary cartilage damage, and an easier and faster arthroscopic surgical technique. Moreover, recently, Moroder et al.[32] showed no clinical difference in the Western Ontario Shoulder Instability score, Rowe score, Subjective Shoulder Value, VAS score, patient satisfaction, and return to work and sport between open Latarjet and open glenoid autograft (J-graft) procedures at 2 years of follow-up in a prospective randomized trial.

In our series, we observed significantly improved functional and subjective positive outcomes, except in 2 patients (10.8%) who had traumatic failure. The MCID cutoff values for patients affected by anterior shoulder instability have been previously reported for the Rowe, American Shoulder and Elbow Surgeons,[19] and Western Ontario Shoulder Instability scores. Because the population affected by shoulder instability, among different studies, is quite similar, we used the same reference value in our study. On the other hand, for the UCLA and Constant scores, we used the MCID cutoff values reported for patients who underwent arthroscopic rotator cuff repair.[20,21] The MCID value is influenced by several patient- and methodology-specific factors, and therefore, it should be calculated separately for each type of disease and each treatment modality, even for a single scoring system. So, the number of patients meeting the MCID values for the UCLA and Constant scores observed in our study could be different. However, the UCLA and Constant scores were developed to evaluate the clinical outcomes of rotator cuff repair and shoulder arthroplasty rather than shoulder stabilization procedures. This could explain the relatively high preoperative UCLA and Constant scores observed in our patients and the low percentage of patients meeting the MCID for the Constant score. The Constant score, indeed, is particularly influenced by shoulder strength in elevation, a parameter that is not affected by shoulder instability.

We did not identify any factor, including bone graft resorption, that was statistically correlated with redislocation. The 11% failure rate observed in this study should be compared with the rates described in the literature for the same patient type. Shaha et al.[4] reported a failure rate of 27.8% after arthroscopic Bankart repair when glenoid bone loss was greater than 20% and suggested that this procedure should not be used if glenoid bone loss is above 13%. Bonnevialle

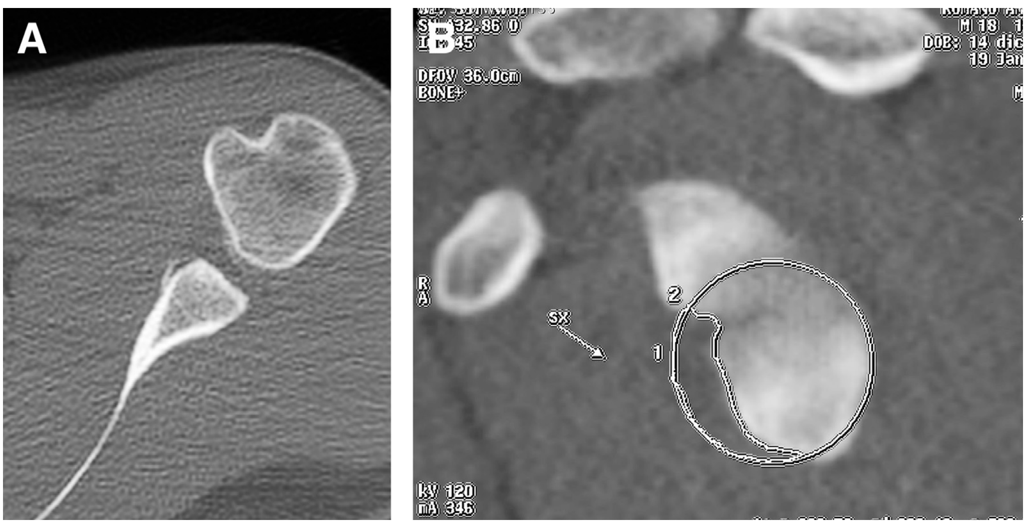

Fig 5. Preoperative computed tomography scans: axial (A) and parasagittal (B) views showing glenoid bone loss of 21% measured with PICO method.

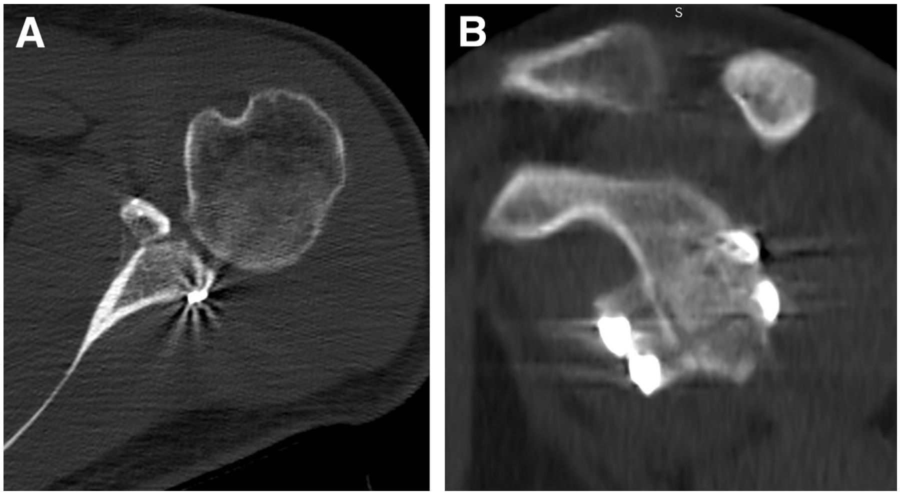

Fig 6. Postoperative computed tomography scans: axial (A) and parasagittal (B) views showing glenoid with bone graft in situ.

et al.[33] reported a recurrence rate of 14.7% and a postoperative positive apprehension rate of 8.8% after arthroscopic Bankart repair with remplissage. Nevertheless, given the short follow-up and the small number of patients in this study, the failure rate of the ASA graft procedure should be confirmed with a higher-powered study. It is important, however, to underline that conversion from ASA graft to the Latarjet procedure was facilitated by the absence of any deltopectoral scar tissue and by the presence of preformed glenoid tunnels, which have been used to guide coracoid screwing.

We observed bone graft resorption in all patients. Only in 2 cases was the inferior glenoid circle perfectly reconstructed as a mirror of the healthy side; however, in the other 17 patients, the graft resorption led to a negative PICO value. The resorption of the cryopreserved graft was also confirmed by histologic examination in the 2 reoperated cases, in which bone tissue was totally absent. Data about glenoid allograft healing are extremely variable in the literature, and our results are different from those of previously published studies. Sayegh et al.[34] reported a 100% rate of allograft bone integration in a meta-analysis of 70 cases. Boehm et al.[35] reported a 100% rate of bone resorption in 10 patients treated with iliac crest allograft fixed by screws, in which the glenoid defect percentage changed from 16.2% preoperatively to 0.6% postoperatively and back to 14% at 1-year follow-up. Taverna et al.[36] reported a 92.3% rate of allograft healing and a 3.8% rate of total resorption using our same graft fixation system after a minimum follow-up period of 2 years. It is interesting to note that all previous studies showed satisfactory glenohumeral stability with good clinical outcomes, independently of graft resorption. If we look at the results of the Latarjet procedure, Di Giacomo et al.[31] found complete coracoid osteolysis at 17.5 months of follow-up in 59.5% of patients, with partial resorption in 93.4%. The use of 1 metallic screw,[37] miniplates,[38] or absorbable screws[39] was not associated with improved osseointegration of the coracoid graft. Di Giacomo et al.[31] observed that the most extensive resorption occurred in the superficial and medial proximal parts of

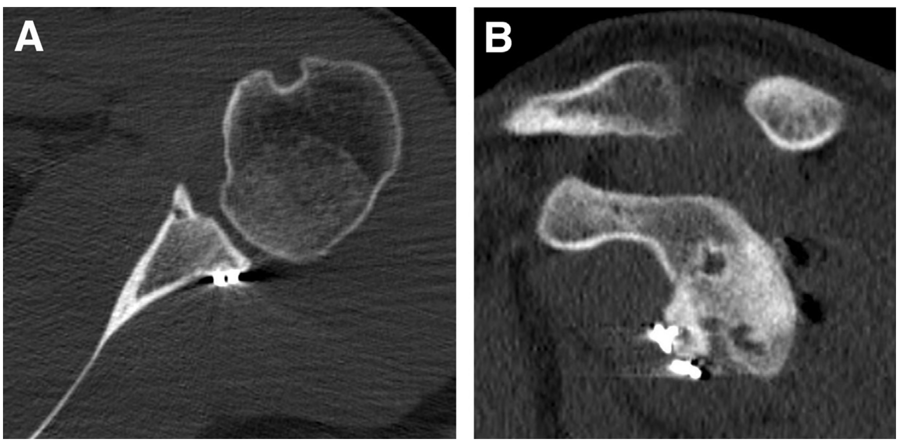

Fig 7. Two-year computed tomography scans: axial (A) and parasagittal (B) views showing partial allograft resorption with positive PICO value.

the graft owing to a stress-shielding phenomenon and lack of mechanical load. They concluded that the stabilizing effect of the Latarjet procedure is mostly a result of sling and capsular effects.[31] Similarly, the improvement in objective and subjective clinical outcomes, as well as the return to sporting activity, observed in our study could be explained only by the creation of anterior capsule scar tissue able to stabilize the humeral head. We believe that the bone graft could improve the inferior capsule healing in the first several postoperative months by creating a stable support to soft tissue and by enlarging the footprint of the repaired anterior capsule. The tenodesis of the upper third of the subscapularis plays a central role in this procedure, with 3 possible effects: first, to increase the contact surface between the capsule and bone; second, to increase the tension of the anterior capsule; and third, to create a sling effect similar to that obtained in the Trillat procedure by pushing the conjoint tendon posteriorly on the subscapularis muscle. Historically, subscapularis tendon anterior tightening procedures, such as the Putti-Platt and Magnuson-Stack procedures, were likely to result in loss of external rotation and elevation so that upper-extremity activity would be performed in relative internal rotation. This results in more posteriorly directed joint forces and abnormal posteroinferior humeral head subluxation, which could cause posterior glenoid wear and osteoarthritis.[40] Arthroscopic tenodesis of the upper third of the subscapularis described in this article is quite different from the open subscapularis plication of the Putti-Platt procedure. First, it does not involve the middle and inferior parts of the tendon, so the observed average loss of external rotation was 5° with the arm in abduction. Second, there is no subscapularis tendon plication or shortening or medial tightening; rather, a superior tendon shift is performed. Previous studies showed that in contrast to medial unidirectional tightening, the anteroinferior capsule and subscapularis shift does not modify joint loads during elevation and abduction.[41] Finally, we would like to emphasize that the right indication for subscapularis upper-third tenodesis is hyperlaxity with external rotation greater than 90°. We cannot exclude that the same procedure performed in patients affected by pure traumatic joint instability with a normal degree of external rotation could have led to joint stiffness and osteoarthritis. Passive reduction of external rotation was similar to the results of previous studies with anterior capsuloplasty. Patients who participated in overhead sports requiring abduction and external rotation were excluded from our study. The limitation of external rotation should be discussed with patients prior to surgery.

We did not observe any osteoarthritis progression in our small and short follow-up series of cases. One explanation for this result could be the precontoured shape of the tricortical bone allograft. Montgomery et al.[42] observed that non-anatomically prepared or too laterally positioned grafts might result in a tendency to push the humeral head over the edge of the graft or posteriorly on the glenoid, which could lead to development of glenohumeral osteoarthritis. A second reason could be the use of parallel glenoid tunneling associated with 6-mm bone buttons that avoids any risk of medial or lateral graft positioning and any hardware problems, maintaining stable orthogonal forces. Nevertheless, further investigation with a larger number of cases observed for a longer period should be performed to evaluate the long-term failure rate and any development of secondary osteoarthritis associated with partial subscapularis tenodesis.

Limitations

There were several limitations to this study. Primarily, this investigation had no control group and no randomization to a different treatment option was made. Moreover, there was a very small sample size and a short follow-up period. The small number of patients resulted from the strict inclusion and exclusion criteria adopted.

Conclusions

Arthroscopic glenoid bone graft combined with subscapularis upper-third tenodesis may be a valid surgical option to treat recurrent anterior instability associated with both bone loss and hyperlaxity.

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