

Original article

Medium-term results of arthroscopic repair of relapsing anteroinferior glenohumeral instability

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ABSTRACT. Objectives: Arthroscopic repair of Bankart lesion has become the treatment of choice of anterior shoulder instability. Our objective is to analyze the medium-term results of arthroscopic Bankart repair. **Material and methods:** Between January 1999 and November 2007, 86 shoulders of 85 patients with diagnosis of relapsing shoulder dislocation were treated arthroscopically. After a mean 62-month follow-up (minimum 24 months) the results obtained were retrospectively assessed according the Rowe and Constant functional scales. A statistical analysis was done of the relation between functional results and age, sex, the side operated, capsulorrhaphy, rehabilitation and postoperative immobilization in our series. Moreover, the validity of MRI for diagnosing Bankart lesion was assessed. **Results:** Eighty-five percent of patients had good or excellent results according to the Rowe scale. The mean Constant scale score was 90.6. The re-dislocation rate in our series was 9%. The statistical analysis showed that female sex and immobilization time were related with worse results according to the Constant scale. **Conclusions:** In our hands, arthroscopic Bankart repair provides results similar to those in other published series. MRI is a useful diagnostic test in our setting, albeit its important implications for the diagnosis of Bankart lesion. Female sex and prolonged immobilization were related with worse functional results.

RESUMEN. Objetivos: La reparación con ayuda artroscópica de la lesión de Bankart se ha convertido en el tratamiento de elección de la inestabilidad anterior del hombro. Nuestro objetivo es analizar los resultados obtenidos a mediano plazo con la reparación de Bankart por vía artroscópica. **Material y métodos:** Entre Enero de 1999 y Noviembre de 2007 fueron intervenidos artroscópicamente 86 hombros en 85 pacientes diagnosticados de luxación recidivante del hombro. Tras un seguimiento medio de 62 meses (mínimo de 24 meses) se evaluaron retrospectivamente los resultados obtenidos según las escalas funcionales de Rowe y Constant. Se analizó estadísticamente la relación entre los resultados funcionales y la edad, el sexo, el lado, la realización de capsulorrafia, la rehabilitación y el tiempo de inmovilización postoperatorio en nuestra serie. Además se evaluó la validez de la RMN para diagnosticar la lesión de Bankart. **Resultados:** 85% de los pacientes obtuvieron resultados buenos o excelentes según la escala de Rowe. La puntuación media de la escala de Constant fue de 90.6. La tasa de reluxaciones en nuestra serie es 9%. En el análisis estadístico se objetivó que el sexo femenino y el tiempo de inmovilización se relacionaron con peores resultados según la escala de Constant. **Conclusiones:** La reparación de Bankart por vía artroscópica en nuestras manos proporciona resultados equiparables a otras series publicadas. La RMN es una prueba diagnóstica útil en nuestro

Level of evidence: IV (Act Ortop Mex, 2011)

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Key words: arthroscopy, shoulder, instability, reconstruction, glenohumeral, joint.

medio aunque con limitaciones importantes para el diagnóstico de la lesión de Bankart. El sexo femenino y la inmovilización prolongada podrían estar relacionados con peores resultados funcionales.

Palabras clave: artroscopía, hombro, inestabilidad, reconstrucción, glenohumeral, articulación.

Introduction

Anteroinferior shoulder instability results from an excessively increased translation of the humeral head in that direction over the glenoid. This pathologic translation is the consequence of a lesion or insufficiency of the shoulder stabilizing mechanisms, whether static or dynamic.¹ Bankart described the detachment of the inferior glenohumeral ligament from the anterior glenoid margin as the characteristic lesion (but not the only one) found in anterior relapsing shoulder dislocation.² Bankart lesion repair has become the gold standard of the treatment of patients with traumatic anterior instability.

Surgery with arthroscopic assistance is becoming the treatment of choice in the approach to anteroinferior glenohumeral instability.

During the late 1980's and early 1990's different stabilization systems were developed with arthroscopic assistance.³ However, these initial techniques were associated with failure rates higher than those obtained with traditional open surgery procedures. This, together with the great technical complexity, led to a limited dissemination, but it represented the germ that led to the development of current systems. The first attempts involved the use of metal screws and staples with disappointing outcomes resulting from the use of metal implants adjacent to the articular surface.⁴ McIntyre and Caspari introduced arthroscopic capsular displacement as an alternative to open surgery.⁵ Snyder et al. applied sutures to fix the capsule to the bone and thus avoid transglenoid sutures and their possible complications, such as suprascapular nerve injury and a painful posterior knot.⁶ Later, Thabit described capsular reduction by means of thermal capsulorrhaphy⁷ and Treacy defined the role of interval closing to support capsular reconstruction in multidirectional instability.⁸

More recently, the introduction of sutures with anchoring has allowed complete articular repair, which may be performed together with a capsular displacement technique when necessary. Much of the success of these sutures is due to the possibility of repairing the capsulolabral complex in its anatomical position at the rim of the articular margin. There are currently numerous implants available for anchoring the capsulolabral complex. There are novel designs for knotless anchoring which seem to provide results similar to the classic knotted spears from the perspective of the im-

provement of glenohumeral function, but with higher redislocation rates in some series.⁹⁻¹² Another very controversial novelty is the use of bioabsorbable tacks, whose results appear to be similar to those obtained with non-resorbable spears.¹³⁻¹⁵

Arthroscopically-assisted instability surgery has contributed to a great extent to the understanding of its anatomy and pathology. All this has allowed identifying clear surgical indications that, together with the improvement of both the technique and the arthroscopic instrumentation, have culminated in success rates similar to those obtained with traditional open procedures.^{1,3,16}

Nowadays arthroscopically-assisted surgery has unquestionable advantages for the treatment of shoulder instability. The major advantages include the greater capacity to identify and treat associated intraarticular conditions, the reduced dissection of muscular structures, less intraoperative bleeding, reduced operative time, shorter hospital stay, less postoperative pain, an easier functional recovery, maximum preservation of joint mobility (such as lateral rotation) and a better cosmetic result.

We believe that having achieved ample experience in the arthroscopic treatment of shoulder instability, it is crucial to review the factors affecting the success or failure of our arthroscopic technique and know the guidelines for patient selection, the surgical successes and failures, and the complementary technical details designed to optimize our outcomes. Due to the importance of all of the above, the objectives of our study are:

- 1) To review the results obtained with the arthroscopically-assisted repair of Bankart lesion in our setting.
- 2) To analyze the clinical, demographic or technical factors that may affect the results of the procedure.

Material and methods

We conducted a retrospective review of the patients who underwent arthroscopic surgery for anterior relapsing glenohumeral instability at our center from January 1999 to November 2007. Eighty-six shoulders were operated in 85 patients with a minimum follow-up of 24 months. All patients were operated on by three surgeons from the arthroscopy unit at our service. Sex distribution was 72 males and 13 females. Mean age at the time of surgery was 26.57 years

± 8.89 (15-60). Laterality wise, there were 40 right and 46 left shoulders.

Inclusion criteria

Patients enrolled had experienced at least two episodes of anterior glenohumeral dislocation. Those with multidirectional instability and those who had undergone surgery for relapsing dislocation were excluded. Ninety percent of cases had more than five dislocations; the mean number of anterior dislocation episodes was 10.32. In 80 patients the first episode followed trauma of the affected limb, and only in 6 cases there was no evidence of trauma or dislocation occurring after banal trauma. The mean time elapsed from the first dislocation to the intervention was 32.18 months (6 months-17 years).

The diagnosis of anterior instability was made considering the history of relapsing dislocation and the physical exam. The grip maneuver was positive in 63 of the 85 patients (74.11%), 26 had a positive anterior drawer test (30.58%), and 23 had a positive repositioning maneuver (27%). Only 19 of the cases had a positive sulcus test during the postoperative assessment (22.35%), and only 27 patients reported shoulder pain (31.76%) (*Chart 1*).

In all patients the work-up included shoulder nuclear magnetic resonance imaging (NMRI), which was evaluated by the Radiology Service independently from patient treatment and the analysis of results. The radiologic evaluation tried to identify the structural lesions that are most frequently associated with the unstable shoulder, like detachments of the glenoid labrum and the anteroinferior capsulolabral complex, with or without an associated bone fragment (Bankart lesion and bone Bankart), Hill-Sachs lesion, SLAP lesions and rotator cuff related conditions (*Chart 2*).

Concerning the surgical technique used, in all cases shoulder arthroscopy was used with the patient in supine decubitus, in a beach chair position, with a traction tower

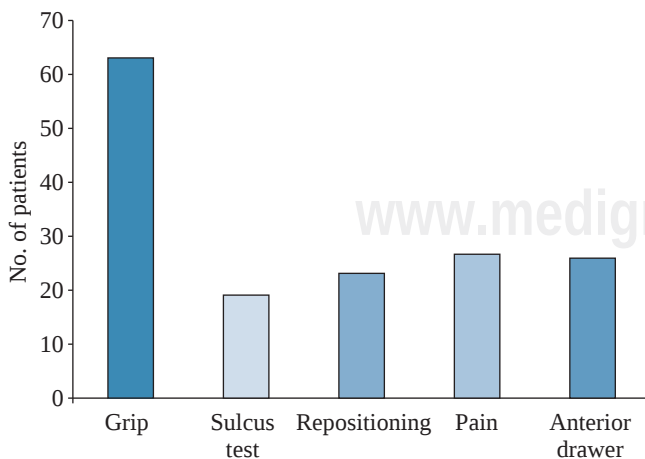


Chart 1. Report of exploratory maneuvers with a positive result in the patient series.

and perfusion pump. A posterior exploration portal and one or two anterior working portals were used depending on each case. Arthroscopy showed 82 Bankart lesions, 60 Hill-Sachs, 9 SLAP lesions (8 type II and one type I), and 5 partial rotator cuff tears (*Chart 3*). We first performed diagnostic arthroscopy of the glenohumeral joint and examined the labrum, the large portion of the biceps, the presence of large SLAP lesions, the mid and inferior glenohumeral complex, the subscapularis tendon, rotating interval lesions, the articular surface of the supraspinous and infraspinous tendons, and the presence of chondral or Hill-Sachs lesions. We then evaluated and mobilized the anterior stabilizing elements, performed capsulolabral detachment, refreshed the anterior glenoid margin until a bleeding surface was created, and re-anchored by means of biodegradable bone spears preloaded with highly resistant sutures for the reattachment of the labrum with one- or two-step techniques, followed by knot tying. For this purpose we used the drilling guide through

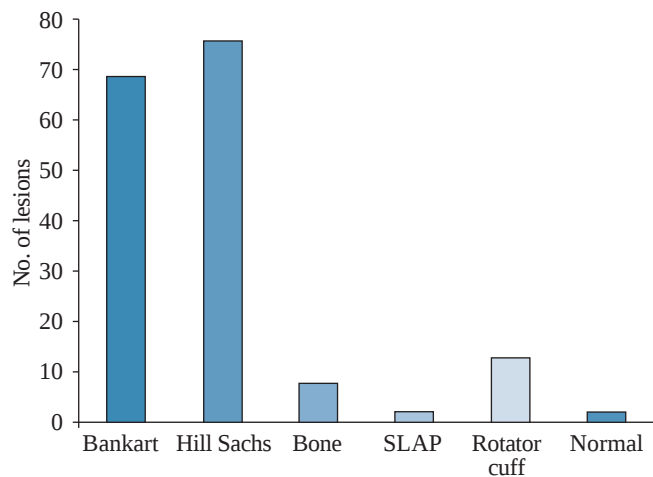


Chart 2. Report of NMRI.

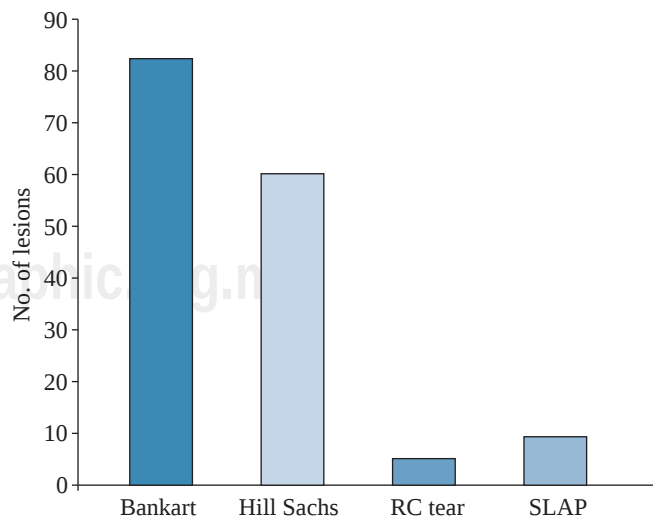


Chart 3. Report of arthroscopically diagnosed lesions at the time of surgery.

the anteroinferior cannula, to perforate and then insert the first anchor at the 5:30 position, precisely on the border of the glenoid articular surface. Next, the sutures were passed through the labrum with the tissue clamp, the threads were retrieved either directly or with suture transfer techniques, and they were tied to secure the capsule on the glenoid articular border. The next step consisted of the reattachment with spears, from the 5:30 position to the 1 position, based on the size of the lesion properly tightening the capsule (*Figure 1*).

The mean number of spears used was 3 (2-6); most of them were of the biosuture tack type, 3.5 mm (Arthrex). Thermal capsulorrhaphy with electrocautery was performed in 59 of the 86 shoulders. The SLAP lesions detected were repaired using spears; 2 rotator interval closures and one subacromial decompression by means of acromioplasty were necessary.

The postoperative protocol followed was the same for all patients. The latter were immobilized in adduction with a sling for a mean of 3.65 weeks (2-6). Then passive limb mobilization was started. Eighty-six percent of patients were referred to rehabilitation at that time. It consisted of passive mobilization, assisted active, and then resistive, mobilization together with a muscle strengthening program.

Results

Statistical analysis

After a mean follow-up of 62 months (24-104), the patients were assessed by the author, who was not involved neither in the treatment nor in the care of patients. Pain, instability and range of motion were assessed in the operated patients; the Rowe and Constant functional scales were applied for the objective quantification of the results. The Rowe scale measures pain, stability, articular balance and limb function with a maximum score of 100, and classifies the results into excellent, good, moderate or poor based on the score.¹⁷ The Constant scale evaluates the results quantitatively according to subjective (pain, activity level, active hand position) and objective (active mobility, abduction force) parameters.¹⁸

Complications and the redislocation rate were analyzed.

A statistical study was conducted of the relation between the dependent variables age, sex, side, number of anchors, performance of capsulorrhaphy, rehabilitation and postoperative immobilization time, and the functional results according to the Rowe and Constant scales, to de-

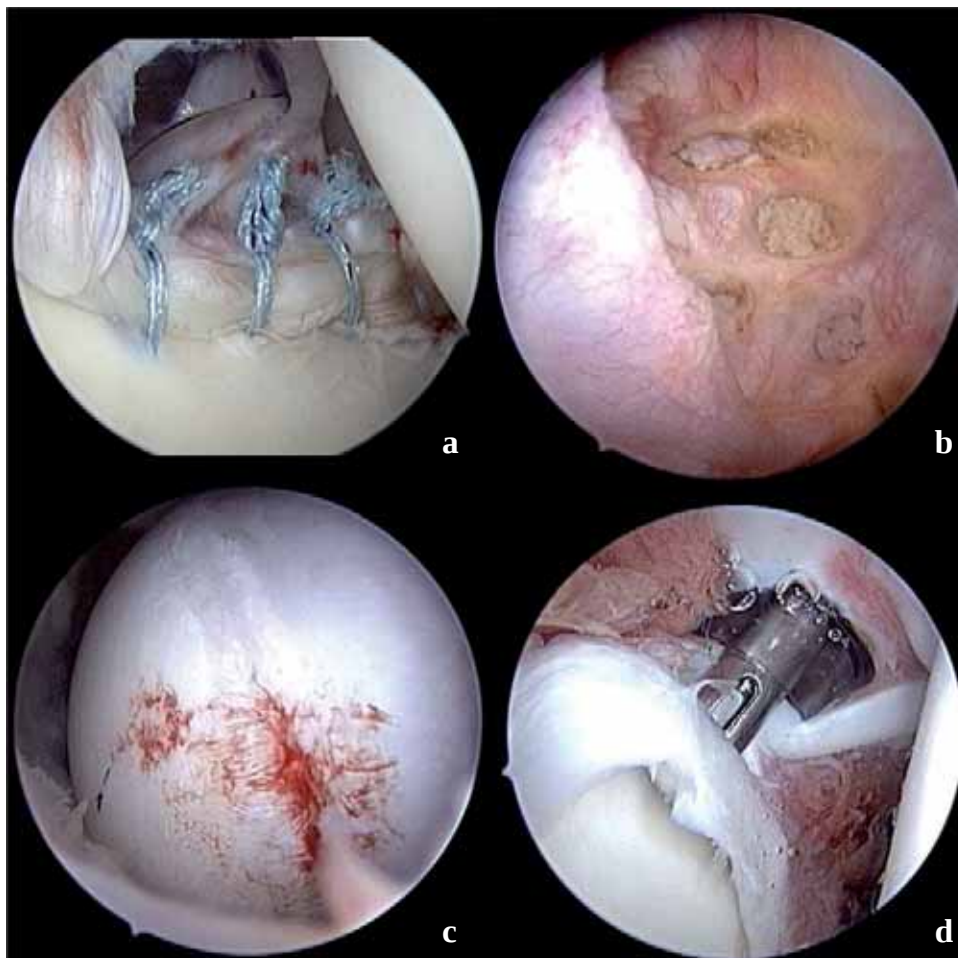


Figure 1. Intraoperative arthroscopic images. a) Final appearance of a Bankart lesion repair. b) Appearance of capsular reduction with thermal capsulorrhaphy with electrocautery. c) Hill-Sachs lesion. d) Type II SLAP lesion found at the time of the repair.

termine which factors could affect the functional results of the operated shoulders. The chi square test and the Wilcoxon test were used for the association among dichotomous variables and with quantitative variables, respectively. The Spearman correlation was used for the study of quantitative variables. A 95% confidence interval ($p < 0.05$) was used in the tests.

Considering arthroscopy as the gold standard for the diagnosis of Bankart lesions, the sensitivity, specificity and predictive values of nuclear MRI were assessed to determine the validity of such test for the diagnosis of Bankart detachment in our series.

Lastly, functional results of patients with a positive and negative sulcus test were compared, as well as between patients with traumatic dislocations and those without a history of trauma or with banal trauma.

Four patients were lost during the follow-up because they quit or could not be contacted to assess their results. Therefore the total number of patients available in the study was 82. According to the Rowe scale, 40 patients had an excellent result (48%), 30 a good result (37%), 7 a moderate one (9%), and 5 a poor one (7%).

The mean Constant test score was 90.6 (0-100).

Eight patients had residual instability; 6 of them had dislocation and 2 self-reduced subluxations, so the redislocation/subluxation rate in our series is 9%. Three neuropathies of the axillary or circumflex nerve were reported (one was reversible with the consequent limitation of the shoulder function), 2 spear migrations (one of them required a new arthroscopic intervention to remove the anchors, replace them and perform thermal capsulorrhaphy), and one patient had radiologic residual glenohumeral arthrosis with little clinical correlation at the present time.

Besides the patient operated on due to anchor migration, other four patients had to be reoperated due to recurrent instability. In 3 cases an arthroscopic procedure was performed, and in one an anterior mini open approach was used and open anterior capsular plication was performed. Of the remaining 4 patients with residual instability, the 2 with a history of subluxation episodes rejected a new intervention and the other 2 with relapsing dislocation are awaiting a new Bankart repair.

Concerning the statistical analysis, a statistically significant association was found only between the postoperative immobilization period and the functional outcome measured with the Constant scale. The results show that the longer the postoperative immobilization period the worse the outcome according to such scale ($p = 0.0075$). The relation between that variable and the Rowe scale approached statistical significance ($p = 0.0515$).

Male patients had a significantly better result than females in the Constant scale ($p = 0.049$). This was not the case in the Rowe scale, in which the sex variable did not achieve statistical significance ($p = 0.92$). The other parameters analyzed, i.e., age, laterality, the number of anchors used, performance of capsulorrhaphy or rehabilitation did

not show a statistical association with the final functional outcome.

Nuclear MRI showed a 71% sensitivity and 50% specificity for the detection of Bankart lesions. The positive and negative predictive values were 93.33 and 15.38, respectively. Based on this, the statistical validity index for nuclear MRI for the detection of Bankart lesions was 69.77%.

Lastly, no differences were found in our series between the patients with atraumatic and traumatic dislocation ($p = 0.74$ according to the Rowe scale and $p = 0.83$ according to the Constant scale) and between those with a positive and negative sulcus test regarding functional outcomes.

Discussion

In our series the rate of patients with excellent or good results measured with the Rowe and Zarins scale is 85%, and the mean score in the Constant scale is 90/100. These functional results are comparable to those obtained in other current series in the literature. Our postoperative recurrent instability rate is 9%, similar to the best results published recently for arthroscopic repair. In the most recently published studies recurrent instability rates with the arthroscopic reanchoring technique with spears range between 4% and 20%.^{16,19-25}

Other complications reported in our study are 3 cases of neuropathy and 2 cases of implant migration. The association between implant migration or protrusion and arthropathy is well known.²⁶ In recent years, metal spears have been replaced by bioabsorbable spears due to problems related with loosening, migration and chondral lesions caused by the former. Despite the fact that the safety and efficacy of bioabsorbable anchors have been widely shown, there are cases of synovitis, osteolysis, foreign body reaction, loosening and chondral lesions reported in the literature resulting from their use.^{27,28} There are new materials under study derived from polylactic acid that intend to minimize the risk of such complications. Only one of our cases had to be reoperated due to arthropathy caused by implant migration; the latter was removed and thermal capsulorrhaphy was performed. Another case had an irreversible circumflex nerve injury, so surgery was cancelled. The other two cases of axillary nerve injury proved to be neuropraxias that subsided later.

The following factors were statistically related with a worse functional outcome in our patients: prolonged postoperative immobilization and female sex. The correlation between prolonged immobilization and a worse outcome makes sense and is a constant in the literature. However, there is not enough consistency to maintain a negative relation with the female sex, so we think that the statistical significance found may be due to the unequal sex distribution in our study. Other articles describe other risk factors associated with higher dislocation rates and, therefore, with worse outcomes, like age, time from the first dislocation to surgery,²⁹ bone loss, the number of implants used or hyper-

laxity.^{21,22,30,31} The performance of thermal capsulorrhaphy in our patients is a time-related issue. It was performed routinely in the first patients in the series when the literature provided hopeful results, but was abandoned after the publication of numerous complications attributable to it, like chondrolysis, adhesive capsulitis, necrosis and capsular rupture.³²⁻³⁵

Nuclear MRI appears to be a useful but limited method. Its high positive predictive value in our setting turns it into a reliable method when the result is positive (when it detects Bankart lesion), but when the result is negative it does not have enough power to rule it out completely (as shown in its low negative predictive value). Adding intraarticular contrast (arthro-NMRI) seems to increase the test's validity index.³⁶⁻³⁸

Our study has numerous limitations and the results and conclusions obtained should be interpreted cautiously. It is a retrospective study without a control group, so the statistical power diminishes considerably.

Definitely, and by means of conclusion, we may say that the arthroscopic glenohumeral stabilization technique using anchors should be the technique of choice for the treatment of anterior relapsing dislocation due to the multiple advantages shown and to the results and dislocation rates similar to those reported with open techniques. Given the improvement in systems and the development of the technique, it is not surprising that current results will be exceeded in the medium term. Additional prospective trials are needed to untangle the factors leading to the success or failure of the technique.

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