

ORTHOPAEDICS

COMPARATIVE STUDY on the MANAGEMENT of GLENOHUMERAL JOINT DISLOCATION Closed Reduction vs. Arthroscopic Remplissage with Bankart Lesion Repair

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ABSTRACT • Background : Conservative treatment of post-traumatic anteroinferior shoulder instability leads to a high failure rate and consequently high recurrence in young and active population. Each recurrence can increase the structural damage of both bony structures and soft tissues (Hill-Sachs lesion, Bankart lesion). Remplissage technique combined with Bankart repair have been proposed as a treatment option. **Hypothesis:** Early arthroscopic treatment for shoulder dislocation will result in better outcome and lower recurrence rate than nonoperative management. **Methods:** We retrospectively reviewed 60 cases from 2010 to 2015 treated by remplissage technique with Bankart repair or closed reduction for anterior shoulder dislocation. All surgeries and closed reductions were done by the same surgeon. Mean age of patients was 30 years, most of them males having experienced one or more recurrent dislocations; mean follow-up was 2 years. Patients with Hill-Sachs lesions < 40% on the articular surface and < 20% of bone defect in the glenoid cavity were included. Exclusion criteria were: glenohumeral arthritis or other inflammation, fracture around the shoulder joint, elderly patients with osteoporosis. All patients included in the study were followed up after 6, 12 and 24 months. Rowe score was used to assess the stability of the shoulders and goniometry to assess the range of motion of the glenohumeral joints. **Results:** The results confirm that the remplissage technique with Bankart repair takes the upper hand over the conservative management and does not produce any severe adverse effect on postoperative shoulder range of motion. A slight restriction ($\approx 10^\circ$) observed in external rotation did not prevent 69% of patients from resuming their preinjury sports activities. At the last follow-up, 90% of patients had a stable shoulder. Conservative management was associated with high rate of recurrence limiting the daily activity of our patients and interfering with their return to sports activities. Except from the recurrence of glenohumeral instability, no patient had a complication following arthroscopic Hill-Sachs remplissage. **Conclusion:** Conservative management after anterior shoulder dislocation including immobilization in neutral position leads to significantly higher and unacceptable high failure rate compared with early arthroscopic remplissage with Bankart repair. The slight restriction in external rotation post remplissage does not significantly affect the quality of life and return to sports activities and further supports the use of this safe, relatively short procedure, in the management of glenohumeral instability with concurrent Hill-Sachs lesions.

Keywords : Bankart lesion; Hill-Sachs lesion

Fakih R, Hamie MR, Yassine MS. Traitement conservateur versus Bankart et remplissage arthroscopique dans les luxations traumatiques de l'épaule. J Med Liban 2016 ; 64 (3) : 175-180.

RÉSUMÉ • Contexte : Le traitement conservateur des luxations traumatiques de l'épaule chez les patients jeunes et actifs s'accompagne d'un taux élevé de récurrences. Toute récurrence entraîne de nouvelles lésions osseuses ainsi que des lésions des tissus mous (Hill-Sachs, Bankart). **Hypothèse :** Une technique précoce de remplissage combiné à un Bankart arthroscopique pourrait être une option thérapeutique supérieure au traitement conservateur dans les luxations antéro-inférieures traumatiques chez les patients jeunes et actifs. **Méthode :** C'est une étude rétrospective de 60 cas de luxations antéro-inférieures de l'épaule, traitées par le même chirurgien par réduction fermée ou bien par remplissage combiné à un Bankart arthroscopique. L'âge moyen des patients est de 30 ans, la plupart sont des hommes ayant subi une ou plusieurs luxations. Le suivi moyen est de 2 ans. Les patients inclus avaient un defect osseux de moins de 40% de la surface articulaire sur le versant huméral (Hill-Sachs) et de moins de 20 % de la surface articulaire sur le versant glénoïdien. Les critères d'exclusion étaient : arthrites gléno-humérales ou autres pathologies inflammatoires, fractures associées de l'épaule, patients d'âge supérieur à 50 ans. Les patients ont été évalués à 6, 12 et 24 mois (Score de Rowe et par goniométrie). **Résultats :** Cette étude confirme que le traitement arthroscopique proposé par les auteurs a permis à 69% des patients de reprendre une activité sportive normale avec une épaule stable dans 90% des cas avec une limitation de 10 degrés de rotation externe. **Conclusion :** Le traitement arthroscopique (par techniques de Bankart et de remplissage combinées) dans les luxations traumatiques de l'épaule aboutirait à un résultat supérieur au traitement conservateur.

INTRODUCTION

The shoulder dislocation occurs more often than all other joints dislocations (1.7% annual rate in general population). The dislocations are most commonly anterior whereas the rate of posterior dislocation is less common [1]. Numerous studies have shown that nonoperative management of glenohumeral instability which includes a short period of immobilization followed by rehabilitation resulted in high rate of recurrence especially in the young active population [1-3].

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Because of this high rate of recurrence, some researchers have investigated the role of arthroscopic treatment of patients after glenohumeral dislocation. In most cases of anterior dislocation, a disruption of the labrum takes place (Bankart lesion) and a posterolateral fracture of the head, known as Hill-Sachs lesion, is also seen.

Bankart lesion is an avulsion of the anterior band of the inferior glenohumeral ligament (IGHL) from the anterior inferior glenoid.

Hill-Sachs lesions were first described in 1940 as the impression left by dense cortical glenoid bone on the softer cancellous bone of the posterolateral humeral head during an anterior glenohumeral dislocation [4]. They occurred in 47% with the first time dislocators and in up to 90% with the recurrent dislocators [5]. The lesions become larger and deeper with recurrent episodes of glenohumeral dislocation causing engagement within the range of functional range of motion in the glenoid cavity when they exceed over 30% of articular surface of the humeral head [6, 7]. Both Palmer and Widen and Burkhart and De Beer described the “engaging” Hill-Sachs lesion, which refers to one that engages the rim of the glenoid when the shoulder is physiologically abducted and externally rotated. Engaging Hill-Sachs lesions lead to recurrent instability and a high rate of failure when treated with arthroscopic Bankart repair alone [4, 8-15]

In 1972 Connolly proposed a surgical procedure which is filling of the humeral head defect with the posterior aspect of the capsule and the infraspinatus tendon to decrease the likelihood of postoperative redislocation. In 2004, Wolf *et al.* described, as a modification of Connolly’s open surgical method, the arthroscopic technique of Hill-Sachs “remplissage” which involves advancing the infraspinatus tendon and posterior capsule to the osseous surface of the Hill-Sachs lesion with anchor sutures, performed in combination with Bankart repair. Koo *et al.* described a modification of this technique in which the sutures are tied over the infraspinatus tendon rather than over the muscle [4, 5, 11, 15].

The aim of remplissage technique consists in using infraspinatus tendon to serve as a checkrein against anterior translation of the humeral head and conversion of an intra-articular lesion into an extra-articular one [4, 5].

The remplissage technique has many advantages : the arthroscopic approach, short recovery time, and avoidance of complications associated with bone grafting. The main cited disadvantage is the theoretical loss of external rotation resulting from the non-anatomic tethering of the infraspinatus tendon [3, 4, 16].

The purpose of our study was to evaluate and compare the outcomes of both remplissage technique with Bankart repair and conservative management in treating anterior glenohumeral instability. We sought to answer two questions: 1) What are the expected functional outcomes following both remplissage and conservative management? and 2) What is the instability recurrence

rate after remplissage technique and conservative management for the treatment of anterior glenohumeral instability?

The hypothesis of this study is that arthroscopic stabilization has better functional outcome permitting faster return to daily and sports activities with better rehabilitation and lower recurrence rate compared with conservative management.

METHODS

We retrospectively reviewed 60 cases from 2010 to 2015 treated by the remplissage technique with Bankart repair or closed reduction for anterior shoulder dislocation. All surgeries and closed reductions were done by the same surgeon. The mean age of patients was 30 years; most of them were males and the mean follow-up period was two years. The patients experienced one or more recurrent dislocations in their history.

In our study, patients who had Hill-Sachs lesions less than 40% on the articular surface, and less than 20% of bone defect in the glenoid cavity were included. Patients who had glenohumeral arthritis or other inflammatory diseases or a fracture around the shoulder joint, or elderly patients with osteoporosis were excluded from the study.

We reviewed charts retrospectively and contacted patients by mailing and phone calling. All patients were followed up prospectively after 6, 12 and 24 months using goniometry to assess shoulder range of motion and Rowe score to assess glenohumeral instability.

MRI and CT were used to assess the labrum detachment, the humeral head fracture, and the glenoid bone loss using axial and oblique views.

The size of the Hill-Sachs lesion was mainly assessed intraoperatively with a calibrated probe. The decision to undertake remplissage was based on the intraoperative dynamic evaluation described by Koo *et al.* and Burkhart and De Beer for engaging Hill-Sachs lesions: the shoulders were considered suitable for remplissage when the Hill-Sachs lesion engaged the anterior glenoid with the arm in 90° of abduction and in external rotation between 0° and 135°.

Surgical Technique

All combined surgical procedures were performed under general anesthesia, some patients underwent interscalene block of the brachial plexus. The procedure was done with the patient in the lateral decubitus position with the shoulder in approximately 30° of abduction and 15° of forward flexion and a traction of 4 kg.

In addition to the standard posterior and anterosuperior portals, an accessory posterolateral portal centered over the Hill-Sachs lesion (the “remplissage portal”) was required so that suture anchors could be inserted orthogonally to the surface of the humeral bone defect.

STEP 1

Glenoid preparation through the anterior aspect of the labrum and capsule

With the arthroscope in the posterior portal, the labrum and the inferior glenohumeral ligament were mobilized so that they could be shifted superiorly and laterally. The anterior glenoid rim was debrided with a shaver from 2 to 6 o'clock in the right shoulder and 10 to 6 o'clock in the left one. Anterior glenoid bone loss was measured with a probe.

STEP 2

Hill-Sachs preparation and humeral anchor insertion

A spinal needle localized the posterolateral portal (3 cm lateral to the posterior portal). Rotation of the humeral head was controlled so that the needle arrived strictly perpendicular and central to the bone defect. The humeral defect was abraded with a shaver.

The Hill-Sachs lesion was assessed using a probe to establish whether it was confined to the articular surface or also involved subchondral bone then a dynamic assessment was done with the arm in abduction, flexion, and external rotation to establish whether the humeral head engaged the anterior glenoid rim. The surface of the Hill-Sachs defect was prepared with a bony or soft tissue shaver, removing a minimal amount of surface bone to obtain a bleeding bed.

Two anchors, one superior and one inferior, and both adjacent to the margin of the defect, were placed.

STEP 3

Suture passing and filling of the humeral defect

The arthroscope was then transferred to the antero-superior portal while the cannula inserted in the postero-lateral portal was withdrawn into the subdeltoid space.

With use of a penetrating grasper, one limb of each suture was retrieved through the posterior aspect of the capsule and the infraspinatus tendon. With the humeral head reduced and the arm placed in neutral rotation, two mattress stitches were tied on the rotator cuff's bursal side with the knots in the extra-articular subdeltoid space, fixing the infraspinatus tendon and posterior capsule to the bleeding and abraded humeral head defect, creating both capsulodesis and tenodesis.

STEP 4

Capsulolabral (Bankart) repair

The arthroscope was then switched back through the posterior portal. A classic arthroscopic Bankart repair was performed with anchor sutures.

Rehabilitation

Patients in both groups underwent a three-phase rehabilitation program supervised by physiotherapists. The first phase consisted of arm sling immobilization in neutral position for four weeks with limited range of motion (pendulum and isometric exercises). The second phase lasting four weeks consisted of progressive passive exercises followed by active-assisted range of motion exercises without resistance. The third phase lasting for another four weeks focused on restoration of full active range of motion with progressively greater resistance exercises. The patients were permitted to return to heavy work and sports activity between four to six months postoperatively.

The patients were retrospectively evaluated at six, twelve months and yearly thereafter by the same surgeon. The mean duration of follow-up was twenty-four months (range, 12-36 months). Postoperative shoulder function and range of motion were assessed with goniometry and with the use of Rowe score.

Descriptive statistics was carried out by number and percent for categorical variables, and mean and standard deviation for continuous ones. Groups were compared by using the chi-square (χ^2) and Fisher's tests for categorical variables, and the Student's t-test and Mann Whitney test for continuous ones, as applicable. Data was entered into the Statistical Package for Social Sciences (SPSS, version 21), which was also used for data management and analyses. Statistical significance was indicated at the 0.05 level.

RESULTS

In our study between 2010 to 2015, 32 patients underwent remplissage with Bankart repair and 28 underwent closed reduction. In our demographic information we can notice how there is male predominance and how frequently the involved limb is the dominant one. Forty-eight patients sustained a sports related shoulder dislocation (Table I).

Twenty-three patients from the conservative group, suffered from redislocation. Two patients from the

TABLE I DEMOGRAPHIC, OPERATIVE AND NONOPERATIVE INFORMATION

	Conservative	Operative	p-Value
Number	28	32	–
Age	30.57 (sd = 5.53)	28.44 (sd = 5.74)	0.15
Sex (male)	20 (71.4%)	23 (71.9%)	0.97
Dominant shoulder	13 (46.4%)	25 (78.1%)	0.01
Prior dislocations (mean, sd)	3.25 (sd = 1.38)	3.25 (sd = 1.08)	1.00
Follow-up (mean, sd)	Not available in data	Not available in data	Not available in data

arthroscopic group redislocated (Table II). One of them reported a new trauma as the cause of dislocation.

We noticed that the redislocation occurs earlier in the conservative group. The peak of redislocation starts after one year and increases with time. The redislocation is not significant and not exceeding 6% after a mean follow-up of 2 years in the arthroscopic group.

On follow-up (12 and 24 months) Rowe score becomes higher in the arthroscopic group with a statistical significance (p value < 0.0001). This score will reach 89 after 24 months in the operative group (Table III).

Females are more prone to hyperlaxity than males with a significant p value. There was a tendency that apprehension test is more likely to be positive with the conservative group compared to the surgical group (post apprehension test showed improvement in the male operative group after 24 months of follow-up with a significant p value < 0.0001) (Table IV).

Of the 48 patients with a sports related dislocation, 15 out of 22 returned to sports activities at previous level while 6 out of 16 returned to sports at previous level in the nonoperative group. Seven patients from the operative group performed contact sports (football, basketball) at a competitive level. There was no statistical difference in the rate of return to sports after a successful conservative and operative treatment (Table V).

Postoperative comparative shoulder mobility at six months and at the time of the last follow-up showed different mean deficit. This deficit decreases to reach a mean of 9° in external rotation with the arm at the side and 10° in abduction at the time of the last follow-up. These results were statistically significant but no patient expressed dissatisfaction with the slight reduction in external rotation (Table VI).

	Conservative N = 23	Operative N = 2	p -Value
Time of re-dislocation (months)	11.74 (sd = 4.11)	17.00 (sd = 1.41)	0.06

Rowe Score at	Conservative	Operative	p -Value
6 months	74.79 (sd = 3.78)	75.44 (sd = 4.54)	0.55
12 months	75.64 (sd = 4.56)	84.53 (sd = 1.81)	< 0.0001
24 months	74.68 (sd = 4.87)	89.25 (sd = 3.05)	< 0.0001

DISCUSSION

The rate of redislocation after initial traumatic shoulder dislocation has varied with different reports.

Mc Laughlin and Maclellan reported a recurrence rate up to 95% [17], Postacchini *et al.* observed a recurrence rate of 92% in the age group above 15 years [18]. Over the past decade, redislocation rate after conservative management in several studies in the US Military Academy appeared to be between 80% and 92%. Kirkley *et al.* reported a redislocation rate of 47% in a prospective randomized study of civilian people under the age of 30 who were treated conservatively [19].

The difference in reported recurrence rates is often correlated with the age of the patients at the time of the first dislocation and the level of activity of the patient resumed after an initial dislocation. These factors determine the risk for reinjury that is associated with an increase of the structural damage of both bony structures and soft tissues

TABLE IV INSTABILITY EVALUATION

	Male			Female		
	Conservative	Operative	p -Value	Conservative	Operative	p -Value
Number	20	23		8	9	
Failures [n (%)]	16 (80.0%)	1 (4.3%)	< 0.0001	7 (87.5%)	1 (11.1%)	0.003
Hyperlaxity [n (%)]	18 (90.0%)	2 (8.7%)	< 0.0001	7 (87.5%)	6 (66.7%)	0.58
Initial postapprehension [n (%)]	20 (100.0%)	18 (78.3%)	0.05	8 (100.0%)	8 (88.9%)	1.00
Postapprehension at 24 months (failures excluded) [n (%)]	4 (100.0%)	1 (4.5%)	< 0.0001	1 (100.0%)	0 (0.0%)	0.11

TABLE V ACTIVITY LEVEL

	Male			Female		
	Conservative	Operative	p -Value	Conservative	Operative	p -Value
Sports-related trauma	15 (75.0%)	16 (69.6%)	0.69	1 (12.5%)	6 (66.7%)	0.05
Return to sports at previous level	5 (33.3%)	11 (68.8%)	0.28	1 (100.0%)	4 (66.7%)	1.00
Contact sports at competitive level	0 (0.0%)	5 (31.3%)		0 (0.0%)	2 (3.33%)	

TABLE VI POSTOPERATIVE COMPARATIVE SHOULDER MOBILITY

	AAE (°)	ER1 (°)	ER2 (°)	IR2 (°)
6 months follow-up				
Operatively treated shoulder	167.34 (sd = 2.56)	53.44 (sd = 3.91)	69.72 (sd = 3.45)	62.78 (sd = 2.57)
Contralateral shoulder	178.06 (sd = 1.85)	67.75 (sd = 4.75)	84.69 (sd = 5.46)	74.72 (sd = 3.45)
Difference	10.72 (sd = 1.94)	14.31 (sd = 3.24)	14.97 (sd = 4.08)	11.94 (sd = 3.45)
<i>p</i> -Value	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Last follow-up (mean, 24 months)				
Operatively treated shoulder	173.38 (sd = 2.87)	59.13 (sd = 4.36)	74.94 (sd = 3.04)	63.47 (sd = 2.14)
Contralateral shoulder	178.06 (sd = 1.92)	68.09 (sd = 4.36)	84.69 (sd = 5.46)	74.56 (sd = 3.34)
Difference	4.68 (sd = 2.43)	8.96 (sd = 5.03)	9.75 (sd = 4.50)	11.09 (sd = 2.96)
<i>p</i> -Value	< 0.0001	< 0.0001	< 0.0001	< 0.0001
AAE: active anterior elevation ER1: external rotation with the arm at the side ER2: external rotation in abduction IR: internal rotation in abduction				

In nearly all cases of anterior dislocation, a disruption of the labrum takes place, the so-called Bankart lesion. In most cases of acute and recurrent dislocation, a posterolateral fracture of the head, known as Hill-Sachs lesion, is seen [4, 8-15].

Hill-Sachs lesions have been reported to occur in 47% of individuals with a first-time glenohumeral dislocation and in up to 90% of those with recurrent anteroinferior glenohumeral dislocation. With recurrent episodes of glenohumeral dislocation, the lesion becomes larger and deeper, increasing the risk of further instability [3, 5].

The “engaging” Hill-Sachs lesion refers to one that engages the rim of the glenoid when the shoulder is abducted and externally rotated. Engaging Hill-Sachs lesions lead to recurrent instability and a high rate of failure when treated with arthroscopic Bankart repair alone [4, 8-15]. Failure to address this humeral osseous defect during arthroscopic and open stabilization surgery for glenohumeral instability leads to an increased rate of recurrence.

The results of the present study confirm the following: 1) Remplissage technique will not produce any severe adverse effect on postoperative shoulder ROM (the slight restriction – approximately 11° – in external rotation did not prevent 68% of the patients from returning to their preinjury sports activities), and 2) at the time of the last follow-up, 90% of the patients had a stable shoulder.

Our interpretation is that both procedures (Bankart repair and Hill-Sachs remplissage) probably contribute to postoperative shoulder stability.

Since remplissage is a nonanatomical technique, our goal was to show that the magnitude of restriction of shoulder motion after the procedure in our study was relatively small: an average of 10° in external rotation with the arm at the side and 11° in external rotation with the arm in abduction. Due to the potential shortening of the arc of motion of the humeral head related to the remplissage, one could have expected a greater limitation of shoulder mobility.

The fact that 68% of our patients were able to return to sports activity, including overhead activities, suggests that there is probably a functional adaptation of the shoulder after surgery with a “rebalancing” between scapulothoracic and glenohumeral motion.

These results confirm also the benefit of the additional arthroscopic procedure: by avoiding engagement of the humeral head bone defect on the glenoid rim, the Hill-Sachs remplissage protects the Bankart repair.

The management of large engaging humeral-side bone defects in patients with anterior glenohumeral instability is unclear and remains controversial. There are many surgical treatment options to restore or reconstruct humeral head anatomy, including humeroplasty or disimpaction, autograft or allograft reconstruction, rotational humeral osteotomy, partial or complete resurfacing, and hemiarthroplasty [3,4,16,20,21]. It is obvious that, compared with these surgical techniques, arthroscopic Hill-Sachs remplissage is much less invasive: no complications related to the technique were observed in our study. In addition to being less aggressive, the arthroscopic procedure does not “burn any bridges” as it leaves open the possibility of performing an open procedure if glenohumeral instability persists [5].

The pathophysiology of recurrent instability in patients treated with arthroscopic Bankart repair has been attributed to a large engaging Hill-Sachs deformity. If not properly managed, a large Hill-Sachs lesion may compromise a Bankart repair and lead to recurrent instability.

The strengths of our study include the multicenter comparison of patient population with excellent follow-up and the accurate methodology to assess mobility. Although every effort was made to be as precise as possible in the measurement of shoulder motion, we did not measure isolated glenohumeral motion, instead we measured global shoulder motion, incorporating both glenohumeral and scapulothoracic motion. However, this does not weaken our study since it is the difference in postoperative mobility between the two sides that is of clinical relevance.

Our study was limited by its retrospective design and by the small number of patients.

It has also other limitations starting from a dilemma in the management of: 1) large engaging humeral-side bone defects (> 40% of the humeral head) in patients with anterior glenohumeral instability [treatment is still controversial till today] and 2) first time anterior dislocation. The second limitation would be the theoretical adverse effect on postoperative shoulder motion and return to sports activity since this is a nonanatomical technique. The third one is how to verify the effective healing of the capsulotenodesis into the Hill-Sachs lesions which could offer better outcome and stabilization. The last one would be the need of additional investigations to assess the long-term results of this novel arthroscopic procedure.

In conclusion, encouraging clinical results have been observed after arthroscopic Hill-Sachs remplissage combined with Bankart repair. The posterior capsulodesis and the infraspinatus tenodesis is effective in stabilizing the shoulder. The slight restriction in external rotation observed is not markedly affected and did not affect return to sports activity.

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