



## Original article

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## ARTHROSCOPIC VERSUS OPEN STABILIZATION FOR TRAUMATIC ANTERIOR SHOULDER INSTABILITY: A COMPARISON OF CLINICAL OUTCOMES

## SUMMARY

With the advance of arthroscopic surgical technique and instruments, minimal invasive arthroscopic reconstruction has become preferred treatment method for Bankart reconstruction.

The aim of this study was to describe surgical technique and report the results after either open or arthroscopic Bankart shoulder stabilization in a retrospective series with a medium-term follow-up.

We performed a retrospective study comprising 43 patients (43 shoulders) with symptomatic, traumatic anterior shoulder instability to compare open versus arthroscopic reconstruction. Twenty eight arthroscopic reconstructions and fifteen open reconstructions were performed using metal suture anchors. All of the patients had the Bankart lesion.

Independent observers examined the shoulders at a median follow-up period of 41.1 months (range, 16 to 57) for the arthroscopic group and 68.1 months (range, 51 to 113) for the open group. The recurrence rate was two of 15 (13%) in the open group and 7.1% (2 out of 28) in the arthroscopic group. During the follow-up, the Rowe score was 84.3 points (range, 39 to 100) in the open group compared with 87.3 points (range, 53 to 100 for the Rowe scores, respectively) in the arthroscopic group.

Both methods produced stable and well-functioning shoulders in the most of patients with the Bankart lesion. Although the arthroscopic technique can lead to a higher recurrence rate, better results were attained for external rotation of the shoulder in the patients treated with this minimally invasive technique.

**Key words:** Bankart lesion, shoulder, arthroscopic reconstruction

## INTRODUCTION

Although the open Bankart procedure is regarded as the standard reconstruction method in traumatic anterior shoulder instability, arthroscopic Bankart reconstruction is reported to provide good results, which can replace open procedure (1-6). With the advance of arthroscopic surgical technique and instruments, minimal invasive arthroscopic reconstruction has become preferred treatment method these days. However, arthroscopic

procedure can be technically demanding and time-consuming, and surgical complications related to recurrence or metal anchor screws have been reported especially in the learning period (7,8).

Compared to arthroscopic procedure, open Bankart reconstruction has been modified and evolved with the introduction of anchor screws, which make the procedure easier without adverse effect on the articular cartilage of the glenoid (9,10).

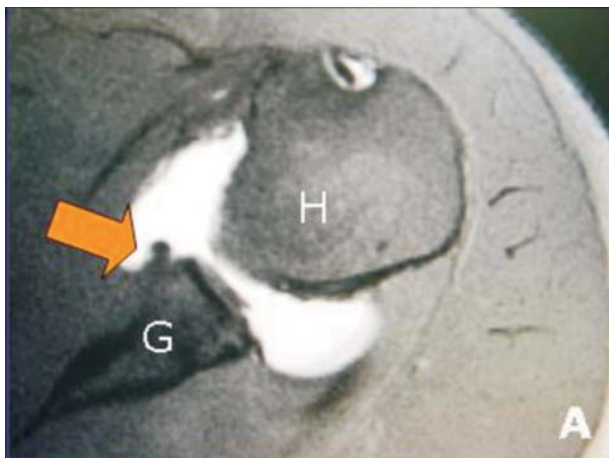
One of the major disadvantages with regards to functional outcome after open Bankart

reconstruction is limitation in the range of motion, especially external rotation (11,12). Arthroscopic procedure repairs Bankart lesion without any damage to normal adjacent tissues, such as the subscapularis tendon. Furthermore, arthroscopic stabilization can be performed as outpatient surgery because there is less postoperative pain. The major disadvantage has been a higher recurrence rate compared with standard open Bankart reconstructions (7). The recurrence rate in most studies ranged between 9% and 20%, and in one study, it was as high as 49% (13). In the literature, the recurrence rate after arthroscopic techniques in all of the reported studies remains approximately twice that of open techniques. Overall, the results of arthroscopic shoulder reconstruction are still less satisfactory than open repair. Nevertheless, there has been little report that has compared the results of the open procedure with the arthroscopic technique using suture anchors (4,7).

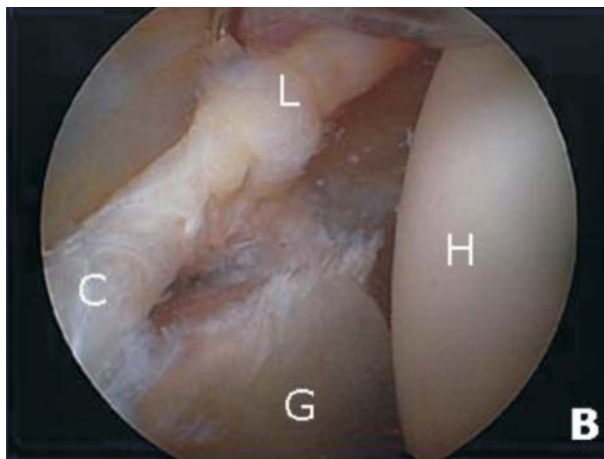
Therefore, the aim of this study was to describe surgical technique and report the results after either open or arthroscopic Bankart shoulder stabilization in a retrospective series with a medium-term follow-up.

#### MATERIAL AND METHODS

Between October 1996 and March 2005, thirty-three patients (33 shoulders) with traumatic unidirectional anterior shoulder instability were operated on by two surgeons. All of the patients had more than two dislocations with subsequent recurrent dislocation or subluxation episodes. All of the patients had the Bankart lesion verified on MRI before and during their operation, *Figure 1.A. - B.*



*Figure 1. A. An axial view of the right shoulder shows anterior inferior labral tear (marked with arrow).*



*B. Arthroscopic view of the right shoulder viewed from anterosuperior portal shows detached anteroinferior capsulolabral complex from the glenoid. (Bankart lesion) (G: Glenoid, H: humeral head, C: Capsulolabral complex, L: anterior band of Inferior glenohumeral ligament)*

Patients with full-thickness rotator cuff tear, greater tuberosity fracture, capsular tear at the humeral insertion, or previous surgery of the shoulder were excluded.

#### Patients' Demographics

The arthroscopic procedure with the use of 2.8mm metal suture anchors (TwinFix Ti, Smith & Nephew, Inc., Andover, Massachusetts) was applied on 28 shoulders.

The open procedure group comprised 15 shoulders, which underwent an open Bankart reconstruction with use of 2.8 mm TwinFix Ti suture anchors (Smith & Nephew, Inc., Andover, Massachusetts) (*N*=7) or Mini Revo suture anchors (Linvatec, Inc., Largo, Florida) (*N*=8). In four cases in which the arthroscopic procedure was converted to an open procedure because of technical difficulties, the patients were excluded from the study.

The average age of the patients was 34 years (range, 24 to 50 years) in the open group and 29 years (range, 20 to 50 years) in the arthroscopic group, respectively. There were 12 men and 3 women in the open group, and 24 men and 4 women in the arthroscopic group. Ten patients in the open group were actively involved in sports activities (3 in overhead sports, 3 in contact sports, 2 in collegiate or professional sports, 2 in recreational level sports) and 22 patients in the arthroscopic repair group were actively involved in sports activities (6 in overhead sports, 4 in contact sports, 4 in collegiate or professional, 8 in recreational level). The number of dislocations before the operation, the elapsed time

from the first dislocation to the surgery, and a patient's age at the initial dislocation are summarized in Table 1.

Table 1. Demographic data of the patients

	Open group	Arthroscopic group
Number of patients	15	28
Mean age (years)	34 (24 to 50)	29 (20 to 50)
Mean follow up (months)	68.1 (51 to 113)	41.1 (16 to 57)
Age at first dislocation	24.6	23.3
< 20	11	21
> 20	4	7
Interval between first dislocation & operation (years)	4.4	3.2
< 3 years	7	18
> 3 years	8	10
Number of dislocations (times)	7 (3 to 11)	9 (2 to 25)
< 10 times	10	17
> 10 times	5	11

## OPERATIVE TECHNIQUE

### 1. Open Bankart reconstruction

The open Bankart repair was carried out in the beach-chair position. In all patients, examination under general anesthesia and diagnostic arthroscopic examination were performed initially. The modified anterior deltopectoral approach was used. Skin incision began at the inferior to coracoid process to axillary crease and the deltopectoral groove was exposed with cephalic vein laterally. Maintaining the arm in the external rotation by the assistant, the proximal two thirds of the subscapularis was incised longitudinally at about 1.5 cm medial from the lesser tuberosity. The capsule was carefully separated from the subscapularis tendon medially. Special attention should be paid to the axillary nerve, which is one finger breath distal to subscapularis. A curved incision was made at the middle of head and the anterior glenoid. A sharp periosteal elevator was used to peel off the anterior labrum (Bankart lesion) from the glenoid wall, and a light decortication was performed on the glenoid margin. Two or 3 drill holes were created on the margin of glenoid and anchor screws were inserted. While the traction sutures in the lateral lip of anterior capsule were pulled proximally and medially to adjust the tension, the lateral lip was sutured to the medial capsule, resulting in plication and the proximal shift of the anterior capsule. During the capsular repair, the shoulder was maintained at 45° external rotation position.

### 2. Arthroscopic Bankart reconstruction

For the arthroscopic Bankart repair, patients were positioned in the same beach chair position. Routine glenohumeral inspection was made through standard posterior, anterosuperior, and anteroinferior portals. The capsulolabral complex was mobilized through the working portal from the anterosuperior portal, and decortication using a bone rasp or burr was made. The lowest anchor site was at the 5:30 position (for the right shoulder). Using a special bone punch, a hole for the screw was created vertical to the glenoid articular surface, *Figure 2.A.*



Figure 2. A. Arthroscopic view showing creation of the screw hole with punch marking for the most inferior screw

A 2.8mm TwinFix Ti anchor screw with a No. 2 Ethibond suture was inserted into the hole. Using the suture hook loaded with No 2-0 prolene, a capsular suture was made at about 1 cm inferior to the anchor or at the same level as the glenoid surface. *Figure 2.B.*

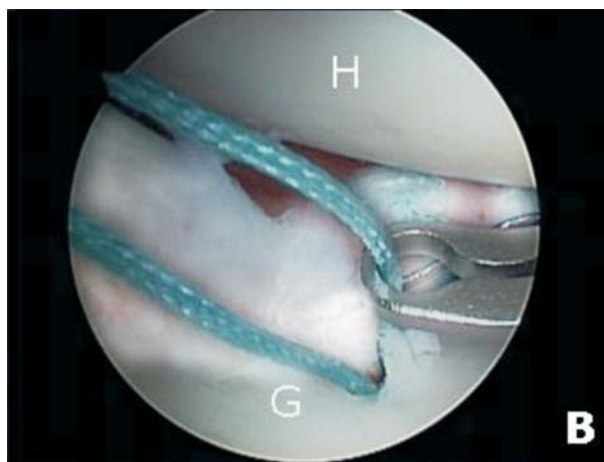


Figure 2.B. Ethibond suture of anchor screw is pulled out using arthroscopic retriever.

Complete repair was achieved with two or three capsular sutures.

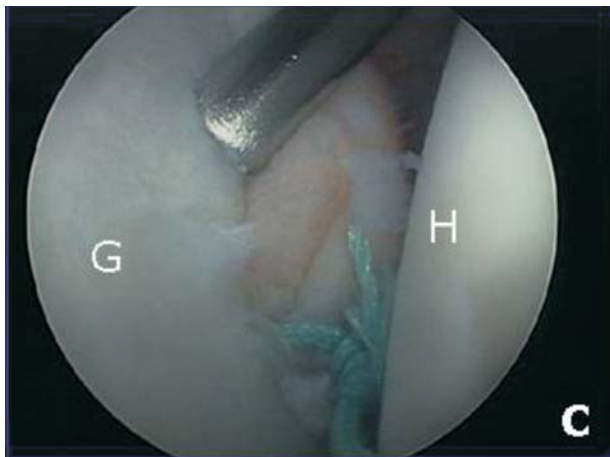


Figure C. After making the first knot in the glenoid, second screw hole is marked with punch.

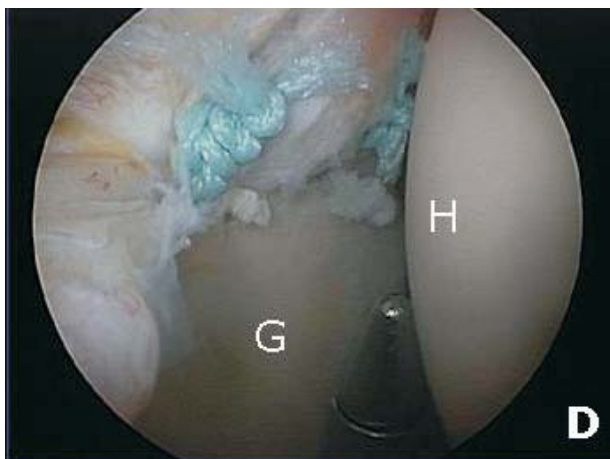


Figure D. Arthroscopic view after repair of Bankart lesion from anterosuperior portal.

The amount of capsular shift should be determined based on the redundancy of the capsule.

### Rehabilitation

Equal rehabilitation was conducted in both groups, which included a sling to limit external rotation for the first four weeks and free active range of motion exercise since then. Muscle strengthening exercises started 6 weeks postoperatively and sports activities such as throwing were allowed in the 6<sup>th</sup> month only if the patients gained more than 90% of strength.

### Follow-up Examination

The follow-up examination was performed after 41.1 months (range, 16 to 57) for the arthroscopic group and after 68.1 months (range, 51

to 113) for the open group. The time period between the first dislocation and the reconstruction, the number of dislocations before the reconstruction, and the age and sex of the patients were comparable for both study groups regarding shoulders that were reexamined during the follow-up (Table 1).

The assessment of stability was performed with use of the apprehension test, which was graded as normal, subluxation, and dislocation. Measurements of range of motion were performed with the shoulder in flexion, abduction, and internal rotation, as well as external rotation in 90° of abduction.

### Statistical Analysis

The Mann-Whitney *U* nonparametric two-tailed test and Fisher's exact test were used to compare the two groups. A *p* value of less than 0.05 was regarded as significant. All the values are presented as median (and range).

## RESULTS

### 1. Pain

None of the patients in both groups complained of moderate or severe pain after the operation. 5 patients (29%) in the open Bankart group did not complain of pain and 10 patients (30%) engaged in sports activity had mild pain. On the other hand, there were no painful sensations in 24 patients (86%), while mild pain was reported by four patients (14%) during sports activities in the arthroscopic group. The degree of pain was more favorable in arthroscopic treatment group.

### 2. Range of motion

The detailed range of motion in both groups is presented in Table 2.

Range of motion in external rotation and abduction was significantly better among the arthroscopic group. However, in terms of range of motion in flexion, abduction, and internal rotation, there were no differences between the study groups.

### 3. Stability

Ten (67%) out of 15 patients in the open Bankart group presented no instability and five (34%) presented apprehension at abduction and external rotation. There were two (13%) re-dislocations after returning to sports activity. However, in the arthroscopic group, 18 (64.3%) of 28 patients showed no instability at all and 8 (28.6%) showed positive apprehension test at abduction and external rotation. There were two (7.1%) re-

dislocations in the arthroscopic groups. There was no statistically significant difference in both groups ( $p < 0.05$ ).

Table 2. Clinical results of the two groups

	Open group	Arthroscopic group	P value
Pain	15	28	
No pain	5	24	
Mild pain at sports activity	10	4	
Moderate/severe pain	0	0	
Range of motion			
Forward flexion	177.3	177	1.0
External rotation	45	56.4	0.08
External rotation at 90 abduction	66.5	79.5	0.03
Abduction	176.1	177.4	0.39
Internal rotation (Thoracic spine level)	5	5	0.92
Instability	7 (3 to 11)	9 (2 to 25)	
No instability	10 (67%)	18 (86.3%)	
(+) apprehension	3 (20%)	8 (28.6%)	
Re-dislocation	2 (13%)	2 (7.1%)	
Rowe score			
Stability score	39	41	
Motion score	19	20	
Function score	26	27	
Bankart grading system	84.3	87.3	0.14

#### 4. Rowe's Bankart Rating System

The follow-up examination was based on Rowe's Bankart rating system (14-16). Mean Rowe's Bankart score in the open repair group was 84.3, which included 43% excellent, 57% good results. Mean score in the arthroscopic group was 87.3 points; 54% excellent, 46% good results. There was no statistically significant difference between the two groups.

#### 5. Complications

One patient had a superficial wound infection that was treated with oral antibiotics, and five patients had severe restrictions of range of motion during the early rehabilitation period. However, they gained external rotation during the last follow-up.

#### DISCUSSION

The decision regarding the use of an arthroscopic or open technique for shoulder stabilization depends on many factors. Likewise, assessing the relative advantages and disadvantages of techniques for stabilization involves a number of important parameters, which can include recurrence

rate, invasiveness, limitation of motion postoperatively, complication rate, technical easiness.

The best procedure for shoulder instability would result in no postoperative recurrences, normal postoperative motion, no postoperative pain and a return to pre-injury performance levels in all patients undergoing the intervention. Certainly, no technique currently available can satisfy these requirements. However, critical assessment of the various open and arthroscopic procedures now available allows for some determination of relative merit. In this study, there was higher percentage of re-dislocations in the open treatment group, whereas there was higher incidence of positive apprehension test in the arthroscopic group. However, there were only two patients with re-dislocations in the open and arthroscopic treatment groups.

No single technique for shoulder stabilization is always regarded as the best one. Numerous factors must be considered in the evaluation of the patient in order to determine the best operation for that individual. There are some of the factors that must be considered, including 1) pathology, 2) instability pattern, 3) surgical technique 4) patients' factor 5) surgeons' factor. Regarding pathology, surgeons should investigate whether there is Bankart lesion with healthy, robust labroligamentous tissue or patulous, thin and poorly defined capsuloligamentous tissue without a Bankart lesion. Next, surgeons should evaluate instability pattern; anterior versus, posterior, multidirectional instability. The patients need to be carefully inspected for general ligament laxity to find the atraumatic multidirectional instability, most of which can be treated with rehabilitation.

Surgical technique ultimately chosen should be based on surgeon's experience, technical ability with the arthroscope, specifics of the pathology including the instability pattern, and aspirations and activity level of the patient postoperatively.

The principal finding of this study was that both arthroscopic and open methods resulted in well-functioning shoulders in the majority of patients after a follow-up period, ranging from 2 to 5 years. There was a slightly higher number of positive apprehensions in the arthroscopic group, but the number of re-dislocation between the study groups was not significant. However, in terms of external rotation, the arthroscopic group had significantly better results.

The first reports on the arthroscopic treatment of Bankart lesions in patients with recurrent post-traumatic anterior shoulder dislocation showed very good results, not only in terms of good stability, but also when it came to satisfactory functional outcome and minimal surgical morbidity, as well as normal range of motion (11,12,17).

Moreover, the arthroscopic techniques have been recently seriously questioned because of the higher recurrence rate compared with open techniques (2,18). Some authors have therefore recommended the discontinuance of arthroscopic techniques for shoulder stabilization (10,17). Kartus et al. compared open and arthroscopic techniques and found no differences in terms of recurrence rate or overall function assessed with the Rowe and Constant and Murley scores (13). The recurrence rate was low in both groups. However, the number of patients was limited. Speer et al. reported a failure rate of 21%, including both dislocations and

subluxations in 52 patients after an average of 42 months (3). Their conclusion was that the arthroscopic procedure should not be regarded as a substitute for open capsular repair.

The conclusion of this study is that both techniques resulted in well-functioning shoulders in a high proportion of patients. The arthroscopic technique led to a higher recurrence rate; however, the difference was not statistically significant. The arthroscopic technique yielded significantly better results than did the open technique for external rotation in abduction.

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## KOMPARACIJA KLINIČKIH REZULTATA NAKON ARTROSKOPSKE ILI OTVORENE STABILIZACIJE KOD TRAUMATSKE PREDNJE NESTABILNOSTI RAMENA

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### SAŽETAK

Sa usavršavanjem artroskopske hirurške tehnike i artroskopskih instrumenata, minimalno invazivna artroskopska rekonstrukcija Bankart-ove lezije postala je standardna terapijska metoda.

Cilj rada bio je opis hirurške tehnike i retrospektivna analiza dobijenih rezultata nakon hirurške, otvorene stabilizacije i artroskopske stabilizacije Bankart-ove lezije.

Sprovedena je retrospektivna studija na 43 bolesnika sa simptomatskom traumatskom prednjom nestabilnošću kod kojih je uradjena artroskopska ili otvorena-hirurška rekonstrukcija. Artroskopska rekonstrukcija Bankart-ove lezije uradjena je kod 28 bolesnika, dok je otvorena-hirurška rekonstrukcija uradjena kod 15 bolesnika.

Na kraju perioda praćenja od 41,1 meseci (prosečno, 16 do 57 meseci) kod 2 bolesnika, od 28 (7,1%) lečenih artroskopskom metodom, došlo je do recidiva nestabilnosti. Od 15 bolesnika lečenih otvorenom-hirurškom metodom, kod 2 (13%) je došlo do recidiva nestabilnosti na kraju perioda praćenja od 68,1 meseci (prosečno, 51 do 113 meseci). Funkcionalni rezultat na kraju lečenja, na osnovu bodovnog sistema Rowe-a, iznosio je, za bolesnike lečene artroskopskom metodom 87,3 poena (prosečno, 53 do 100 poena), dok je za bolesnike lečene otvorenom-hirurškom metodom iznosio 84,3 poena (prosečno, 39 do 100 poena).

Primena obeju metoda omogućava stabilnu i dobru funkciju ramena kod većine bolesnika nakon rekonstrukcije Bankart-ove lezije. Mada je nakon artroskopske intervencije evidentirana nešto veća učestalost recidivantne nestabilnosti ramena, kod bolesnika lečenih ovom minimalnom, invazivnom tehnikom zabeležena je bolja spoljašnja rotacija u zglobu ramena.

**Ključne reči:** Bankart-ova lezija, rame, artroskopska rekonstrukcija, otvorena-hirurška rekonstrukcija