

# Comparison of Open and Arthroscopic Stabilization for Recurrent Shoulder Dislocation in Patients with a Bankart Lesion

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## ABSTRACT

We performed a prospective study of 117 patients (119 shoulders) with symptomatic, recurrent anterior post-traumatic shoulder instability to compare open versus arthroscopic reconstruction. Arthroscopic reconstructions ( $N = 66$ ) were performed using bioabsorbable tacks (Suretac fixators), whereas open reconstructions ( $N = 53$ ) were performed with suture anchors. All of the patients had a Bankart lesion. Independent observers examined 108 of the 119 shoulders (91%) at a median follow-up period of 28 months (range, 24 to 63) for the arthroscopic group and 36 months (range, 24 to 63) for the open group. The recurrence rate, including both dislocations and subluxations, was 9 of 60 (15%) in the arthroscopic group, compared with 5 of 48 (10%) in the open group. At follow-up, the Rowe score was 93 points (range, 39 to 100) and the Constant score was 91 points (range, 56 to 100) in the arthroscopic group, compared with 89 points (range, 53 to 100 and 57 to 100 for the Rowe and Constant scores, respectively) for both scores in the open group. The only significant difference was in external rotation in abduction, which was  $90^\circ$  (range,  $50^\circ$  to  $135^\circ$ ) in the arthroscopic group and  $80^\circ$  (range,  $25^\circ$  to  $115^\circ$ ) in the open group. Both methods produced stable and well-functioning shoulders in the majority of patients.

The open Bankart procedure is regarded by many surgeons as the accepted standard for shoulder stabilization surgery,<sup>24,25</sup> and nowadays most patients with posttraumatic, recurrent shoulder instability are probably treated with the open technique.<sup>9,10,23-25</sup> This procedure is, however, technically demanding and time-consuming, and reports of surgical complications, such as glenoid rim fractures, have led to modifications of the original Bankart technique.<sup>11,22</sup> One of the most important modifications of the Bankart technique was the introduction of suture anchors, which make the procedure technically easier without any negative effect on the results in terms of shoulder stability.<sup>11,14,22</sup> Limitation in the range of motion, especially external rotation,<sup>13,15,33</sup> is one of the major drawbacks in terms of functional outcome after open Bankart reconstruction.

The first arthroscopic stabilizing procedure was described in 1993 and involved the use of a metal staple.<sup>5</sup> The authors reported that their 24 patients had a 16% recurrence rate and also reported a restriction in external rotation and a high risk of complications, mainly due to loose staples. Since then, several studies have reported on different arthroscopic techniques for shoulder stabilization.<sup>2,3,7,8,12,18,19</sup> Most of the techniques involve the use of intraarticular sutures, with or without anchors, for the re-fixation of the loose capsulolabral complex.<sup>3,7,16,21,26-28,32</sup> Selective repairs of a Bankart lesion can be performed arthroscopically 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. The recurrence rate in most studies has been between 9% and 20%,<sup>6,31</sup> and in one study it was as high as 49%.<sup>30</sup> In a previous study by Karlsson et al.<sup>12</sup> on arthroscopic shoul-

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der stabilization with use of bioabsorbable tacks in 82 patients, the redislocation rate was 10% after a median follow-up period of 27 months. Taken together, the recurrence rate after arthroscopic techniques in all of the reported studies remains approximately twice that of open techniques.<sup>17,31</sup>

Bioabsorbable tacks have been used during the past decade to make the surgical procedure simpler.<sup>26,28,31</sup> This implant should ideally maintain soft tissue fixation until healing occurs and then disappear by absorption. There have, however, been only a few reports on the results after using bioabsorbable tacks.<sup>1,2,12,13</sup>

Most of the previous studies of arthroscopic shoulder stabilization are limited in terms of the length of the follow-up period, the number of patients included, or both. Moreover, there is a definite lack of well-controlled studies that compare open and arthroscopic techniques in prospective series. The aim of this study was, therefore, to report and compare the results after either open or arthroscopic Bankart shoulder stabilization in a large number of patients operated on in a prospective series with a medium-term follow-up.

## PATIENTS AND METHODS

Between October 1992 and March 1997, 117 patients (119 shoulders) with unidirectional posttraumatic shoulder instability were operated on by one of three surgeons with a special interest in shoulder surgery. All of the patients had at least one dislocation with subsequent recurrent dislocation or subluxation episodes. In the whole study group, no operation, apart from diagnostic arthroscopy in three patients, had been performed before the reconstruction operation. All of the patients had a Bankart lesion verified during their operation.

### Allocation Procedure

The patients were operated on in a prospective consecutive series. Preoperatively, both methods of reconstruction were explained to all of the patients, and they were then asked to choose one of them: open or arthroscopic stabilization. If the patient did not wish to make the choice, the surgeon suggested a method, with the aim of creating comparable demographics in the study groups. No consideration was taken as to the number of dislocations or the time period between the first dislocation and the reconstruction in determining the allocation into study groups. The patients were also informed that if no Bankart lesion was found at the time of surgery an open capsular shift would be performed and the patient would be excluded from the study.

### Demographic Information

The group that underwent an arthroscopic procedure with use of 8-mm Suretac fixators (Acufex, Smith & Nephew, Inc., Andover, Massachusetts) was composed of 66 shoulders. The open procedure group comprised 53 shoulders, which underwent an open Bankart reconstruction with

use of 3.7-mm TAG (Acufex) suture anchors ( $N = 24$ ) or Mitek suture anchors (Mitek Products, Inc., Westwood, Massachusetts) ( $N = 29$ ). 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.

### Surgical Procedures

In the arthroscopy group, eight patients were operated on with the extraarticular procedure as described by Resch et al.<sup>20,21</sup>; the intraarticular technique described by Warner and Warren<sup>31</sup> and Speer et al.<sup>26</sup> was used for the rest of the patients. The anterior glenoid was prepared to ensure a bleeding surface free from soft tissues, and the capsulolabral complex was mobilized. The anterior glenoid rim was decorticated and troughs were created, usually at the 2-o'clock, 3-o'clock, and 5-o'clock positions (in a right shoulder). If the capsulolabral complex was of good quality and could be shifted laterally and proximally to its original place of insertion, the fixation was made with the intraarticular technique. The fixator was seated into the drill holes at the bottom of the troughs, and the capsulolabral complex was compressed to the anterior glenoid rim by the head of the fixator, which was fully visible from inside the joint. In eight patients in whom the quality of the labrum was considered to be less good, an extraarticular fixation at the lower and middle part of the glenoid, together with an intraarticular fixation to the upper part of the labrum, was performed. The head of the fixator was placed outside the joint capsule with use of the extraarticular technique, thus compressing the capsule toward the anterior glenoid rim. In all of the patients, the lower intraarticular or extraarticular portal was made by means of the "slalom" approach described by Resch et al.<sup>20,21</sup> In all patients, either two or three Suretac fixators were used.

In the open fixation group, the patients were operated on with use of an open technique similar to the original one described by Rowe et al.,<sup>24</sup> except that suture anchors were used instead of curved drill holes and no coracoid osteotomy was performed. The skin incision was made from just below the coracoid process toward the axilla. The subscapularis tendon was divided approximately 1 cm from its insertion on the lesser tubercle. The muscle and the capsule were separated, and a vertical capsular incision was made just lateral to the anterior glenoid rim. The capsulolabral complex was then mobilized medially. Two or three (in most cases three and in one patient four) drill holes were made in the anterior glenoid rim with use of specially designed drill bits. The TAG suture anchors or Mitek suture anchors with an attached nonabsorbable suture were implanted in the drill holes, which were approximately 20 mm deep, and the sutures were pulled firmly to secure subcortical fixation. With the arm in 20° of external rotation, the lateral capsule was sutured toward the anterior glenoid rim, causing a capsular shift of approximately 1 cm. The medial complex was sutured over the lateral capsule, if possible, and the subscapularis tendon was then reinserted with absorbable sutures.

Rehabilitation

The patients in both groups underwent a similar rehabilitation protocol and wore a sling to limit external rotation during the first 4 postoperative weeks. Free passive flexion and internal rotation movements were used from the 1st postoperative week. At 4 weeks, free active range of motion in all directions was permitted. Strengthening exercises and coordination training were started at 6 weeks. Passive exercises were used as needed if the patient showed slow return of range of motion through the entire postoperative rehabilitation period. Throwing and contact sports were allowed at 6 months, provided that the shoulder had regained full functional stability.

Follow-up Examination

Two to 5 years after the operation, 108 of the 119 (91%) shoulders were examined. Eleven patients either refused to attend the follow-up examination or were geographically unable to do so. Independent observers performed the follow-up examination after 28 months (range, 24 to 63) for the arthroscopic group and after 36 months (range, 24 to 63) for the open group ( $P < 0.0001$ ). 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 in the shoulders that were reexamined at the follow-up (Table 1).

The follow-up examination included assessment and assignment of scores with use of the methods of Constant and Murley<sup>4</sup> and Rowe et al.<sup>24</sup> The assessment of stability was performed with use of the apprehension test, which was graded either as normal, as discomfort in maximum external rotation without signs of instability, or as a sign of subluxation, including muscular contraction. 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. Assessments of isometric muscular strength with use of the Isobex dynamometer (Curmed AG, Ostermündingen-Bern, Switzerland)

TABLE 1  
Characteristics of the Patients Who Attended the Follow-up Examination

Variable	Group		P value
	Arthroscopic	Open	
Number	60	48	
Male/female ratio	45/15	38/10	0.65
Age (years) <sup>a</sup>	26 (15–62)	27 (16–47)	0.46
Time to reconstruction (months after injury) <sup>a</sup>	31 (4–360)	42 (7–240)	0.18
Number of dislocations before surgery <sup>a</sup>	6 (1–30)	10 (2–60)	0.05

<sup>a</sup> Median (range).

land) were performed in abduction in the scapular plane, as suggested for the Constant and Murley score.<sup>4</sup>

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 given as the median (and range).

RESULTS

There were seven redislocations in the arthroscopic group and two in the open group ( $P = 0.29$ ). In terms of stability, the procedures of 9 of 60 (15%) shoulders in the arthroscopic group and 5 of 48 (10%) in the open group were regarded as failures; that is, they had redislocations or signs of subluxation, or both ( $P = 0.57$ ) (Table 2). Differences between groups were not significant.

In the arthroscopic group, five early complications were

TABLE 2  
Comparison of Results at the Follow-up Examination for Shoulders with Arthroscopic or Open Reconstruction

Variable	Group		P value
	Arthroscopic	Open	
Number	60	48	
Follow-up (months) <sup>a</sup>	28 (24–63)	36 (24–63)	<0.0001 <sup>b</sup>
Rowe score at follow-up (points) <sup>a</sup>	93 (39–100)	89 (53–100)	0.49
Constant score at follow-up (points) <sup>a</sup>	91 (56–100)	89 (57–100)	0.23
Constant score noninjured side (points) <sup>a</sup>	91 (65–100)	97 (79–100)	0.14
External rotation in abduction (deg) <sup>a</sup>	90 (50–135)	80 (25–115)	0.0001 <sup>c</sup>
Strength in abduction (kg) <sup>a</sup>	8.3 (2.3–17.6)	9.5 (2.5–13.4)	0.44
Redislocations during follow-up (No.)	7/60	2/48	0.29
Subluxations during follow-up (No.)	2/60	3/48	
Failure in terms of stability (redislocation and subluxation) (%)	9/60 (15)	5/48 (10)	0.57
Discomfort in maximum external rotation without signs of instability (No.)	13/60	17/48	

<sup>a</sup> Median (and range).

<sup>b</sup> The follow-up period was significantly longer in the group operated on using the open technique.

<sup>c</sup> The external rotation in abduction was significantly better in the arthroscopic group.

registered. One patient had a transient sensory ulnar nerve palsy. One patient had marked pain 8 weeks after the operation and, during a second arthroscopic procedure, the loose head of a Suretac fixator was found intraarticularly. The loose body was removed and the patient recovered uneventfully. The shoulder was stable, the Bankart lesion was healed, and this patient has not had a recurrence. Three patients had severe restrictions of range of motion during the early rehabilitation period, but these restrictions resolved after intensive physical therapy. Four patients in the arthroscopic group had recurrent instability and were operated on during the follow-up period with use of the technique described for those patients in the open group. The initial procedures of all of these patients were regarded as failures.

Among the patients in the open group, six early complications were registered. 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. Three patients from the open group underwent additional surgery during the follow-up period. One patient who had recurrent instability was again operated on with the same technique as at the first operation. Two patients underwent an arthroscopic procedure and manipulation under anesthesia for severe restrictions in range of motion. The patients from both groups who were reoperated on for recurrent instability were excluded from the follow-up examination. Their procedures were, however, reported as failures in terms of stability.

At follow-up, no significant differences were found between the study groups for the Rowe and Constant and Murley scores or the strength measurement (Table 2). Range of motion in external rotation and abduction was significantly better among the arthroscopic group ( $P < 0.0001$ ) (Table 2). However, in terms of range of motion in flexion, abduction, and internal rotation, there were no differences between the study groups.

## DISCUSSION

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 of between 2 and 5 years. There was a higher number of redislocations in the arthroscopic group, but the difference between the study groups was not significant. However, in terms of external rotation, the arthroscopic group had significantly better results.

The redislocation rate in the arthroscopic group was well on a par with that seen in previous studies, which reported favorable results in terms of stability and function.<sup>12,13,20,21,26</sup> The overall results for the open group appeared to be similar to those of several classic studies.<sup>9,10,24,25</sup> However, they were not as good as those in the study of Rowe et al.,<sup>24</sup> which had only 3.5% redislocations.

The strength of this study was that the patients were operated on in a prospective series by experienced surgeons with a specific interest in shoulder surgery. The

study also includes a fairly large cohort, with a medium-term follow-up, and independent observers conducted all of the reexaminations. Potential weaknesses of the study were that the arthroscopic group had an 8-month shorter follow-up period and a lower, although nonsignificant, number of dislocations before the reconstruction. Another problem, which we are aware of, is that the surgeon might have caused a selection bias in the assignment of patients to study groups, even though efforts were made to minimize this effect.

The first reports on the arthroscopic treatment of Bankart lesions in patients with recurrent posttraumatic 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.<sup>16</sup> However, most of these studies were nonrandomized, and some compared small study groups and had a short follow-up period. Moreover, the arthroscopic techniques have recently been seriously questioned because of the higher recurrence rate compared with open techniques.<sup>7,30</sup> Some authors have therefore recommended the discontinuance of arthroscopic techniques for shoulder stabilization.<sup>7</sup> Kartus et al.<sup>13</sup> 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. The recurrence rate was low in both groups. However, the number of patients was limited. Speer et al.<sup>26</sup> reported a failure rate of 21%, including both dislocations and subluxations, in 52 patients after an average of 42 months. Their conclusion was that the arthroscopic procedure should not be regarded as a substitute for open capsular repair.

Most previous studies of arthroscopic shoulder stabilization have involved the use of suture techniques, either with transglenoid sutures<sup>3</sup> or with the attachment of the detached capsulolabral complex to the glenoid neck with use of intraarticular suture anchors, as described by Wolf et al.<sup>32</sup> The posterior wall of the glenoid is not penetrated when this technique is used. There has been extreme variation in the results, especially in terms of the recurrence rate, which has been reported between 0%<sup>16,32</sup> and 49%.<sup>30</sup> Recent studies have, however, produced consistently better results,<sup>12,13</sup> but, in spite of this, the recurrence rate is between 10% and 20% when arthroscopic suture techniques are used.<sup>17,30</sup> The use of a cannulated, biodegradable implant device to avoid intraarticular hardware-related and suture-related complications was described approximately 10 years ago.<sup>31</sup> In spite of the theoretical advantages of biodegradable tacks, there are only a few studies reported in the literature of the results after use of these tacks in shoulder stabilization surgery. Few of the previous studies have been prospective or randomized,<sup>13</sup> comparing the results with the accepted standard of open Bankart reconstruction. The present study was both prospective and controlled.

In previous reports, the recurrence rate after use of biodegradable tacks has varied between 6% and 21%.<sup>20,29</sup> The largest studies are by Altchek,<sup>1</sup> who reported a 7% recurrence rate, Resch et al.,<sup>20</sup> who reported a 9% recur-

rence rate in 100 patients followed up for an average period of 35 months, and by Karlsson et al.,<sup>12</sup> who reported a 10% recurrence rate in 82 patients followed for an average period of 27 months. The failure rate in the present study was somewhat higher, that is, 15% in the arthroscopic group. The failure rate in the open reconstruction group was 10% (not a significant difference), suggesting that either method can be used for patients with recurrent posttraumatic anterior shoulder dislocations and a Bankart lesion. The degree of capsular laxity is therefore probably a crucial factor in determining the ultimate success of either method. As a result, we believe that, in patients with posttraumatic shoulder instability and a Bankart lesion, the decision to proceed with either an open or an arthroscopic procedure should be individualized and should be based more on the experience of the surgeon and the choice of the patient than on the age of the patient, the number of dislocations, the time interval between the original dislocation before surgery, or whether the patient participates in sports. However, we must bear in mind that, in the present study, the number of dislocations before reconstruction as well as the follow-up periods were not completely comparable between the study groups.

In terms of function, there were no differences between the study groups with use of the standard scoring scales of Rowe or Constant and Murley as outcome measures. There was, however, a difference in external rotation in favor of the arthroscopic technique. This is not surprising, as this is the main advantage of the arthroscopic technique. There were no differences in terms of early or late complications or need for additional surgical procedures.

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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