Comparison of Arthroscopic and Open Anterior Shoulder Stabilization : A Two to Six-Year Follow-up Study

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Comparison of Arthroscopic and Open Anterior Shoulder Stabilization

A Two to Six-Year Follow-up Study*

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Abstract

Background: **Sixty-three consecutive patients with recurrent traumatic anterior shoulder instability underwent operative repair. The decision to select either arthroscopic Bankart repair or open capsular shift was based on the findings of an examination under anesthesia and the findings at the time of arthroscopy. Thirty-nine patients with only anterior translation on examination under anesthesia and a discrete Bankart lesion underwent arthroscopic Bankart repair with use of absorbable transfixing implants. Twenty-four patients with inferior translation in addition to anterior translation on examination under anesthesia and capsular laxity or injury on arthroscopy underwent an open capsular shift.**

Methods: **Treatment outcomes for each group were determined according to the scoring systems of Rowe et al., the American Shoulder and Elbow Surgeons, and the Short Form-36. Failure was defined as recurrence of dislocation or subluxation or the finding of apprehension. Fifty-nine (94 percent) of the sixty-three patients were examined and filled out a questionnaire at a mean of fifty-four months (range, twenty-seven to seventy-two months) following surgery.**

Results: **There were no significant differences between the two groups with regard to the prevalence of failure or any of the other measured parameters of outcome. An unsatisfactory outcome occurred after nine (24 percent) of thirty-seven arthroscopic repairs and after four (18 percent) of twenty-two open reconstructions. All cases of recurrent instability resulted from a reinjury in a contact sport or a fall less than two years postoperatively. The treatment groups did not differ with regard to patient age, hand dominance, mechanism of initial injury, duration of follow-up, or delay until surgery. Measured losses of motion were minimal and, with the exception of forward elevation, slightly more of which was lost after the open capsular shifts ($p = 0.05$), did not differ between the two forms of treatment. Approximately 75 percent of the patients in each group returned to their favorite recreational sports with no or mild limitations. As rated by the patients, the result was good or excellent after thirty-one (84 percent) of the arthroscopic procedures and after twenty (91 percent) of the open procedures.**

Conclusions: **Arthroscopic and open repair techniques for the treatment of recurrent traumatic shoulder instability yield comparable results if the procedure is selected on the basis of the pathological findings at the time of surgery.**

Arthroscopic Bankart repair has become increasingly popular as a method for treatment of instability. The basis for this enthusiasm has been the impression that it is a less morbid surgical alternative to open repair and that it yields a better cosmetic result and a better overall range of motion and function[4,5,9,10,13,19]. However, we do not know of any studies validating this impression. Although a variety of methods for arthroscopic repair have been reported, the failure rate for all methods has been relatively high[4,5,12,14,21,24,33,35,41,60]. The reported failure rates after open repair have tended to be lower, but they have been as high as 37 percent[14,18,20,24,31,33,35,41]. Few investigators have attempted to compare arthroscopic and open repair, and the method of patient selection has remained unclear[17,19,21,22]. Furthermore, methods of evaluation have varied, and most studies have not included an independent observer blinded to the method of treatment.

Several authors have suggested that the best candidate for an arthroscopic repair is one with instability due to a discrete Bankart lesion without any capsular laxity or injury[34,49,50,52,56,59]. Alternatively, anteroinferior capsular shift has been reported to be a successful form of open repair in cases of traumatic instability with capsular laxity either in combination with a Bankart lesion or as an isolated finding[2,11,61].

The purpose of the present study was to determine the effectiveness of a method of selection of patients for arthroscopic repair or open anteroinferior capsular shift based on perioperative findings. One surgeon performed these procedures, and an independent observer who was blinded to the method of treatment examined

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TABLE I
PATIENT DEMOGRAPHICS

Variable	Arthroscopy Group	Open-Repair Group
No. of patients	37	22
Age* *(yrs.)*	28 (16-53)	27 (15-47)
Duration of follow-up* *(mos.)*	52 (27-65)	55 (27-72)
Dominant extremity†	18 (49%)	8 (36%)
Gender† (M/F)	33/4	18/4
Dislocated/subluxated†	22/15	18/4
Interval from initial episode of instability until surgery* *(mos.)*	35 (3-360)	47 (3-228)
Mechanism of initial instability†		
Contact sport	21	16
Work incident	13	3
Other	3	3

*The values are given as the mean, with the range in parentheses.
†The values are given as the number of patients.

the patients. We hypothesized that this method of treatment selection, in which one of two procedures is chosen to address specific pathoanatomy, would yield an equivalent outcome in each group.

Materials and Methods

Between January 1991 and December 1994, the senior one of us (J. J. P. W.) operated on 134 patients (136 shoulders) with shoulder instability. Patients with failure of prior surgery (thirty-one patients), posterior instability (ten patients), multidirectional instability (seven patients), an associated SLAP (superior labrum anterior posterior) lesion (twenty patients), or marked articular surface loss (three patients) were excluded from the analysis. Sixty-three consecutive patients with primary traumatic anterior dislocation or subluxation with arthroscopically confirmed capsulolabral injury were evaluated in this prospective and nonrandomized study. All subjects had given informed consent, and an institutional review board had approved the study.

Patient Selection

Patient selection was uniform during the course of this study. All patients related a history of a traumatic event that had caused either dislocation or subluxation of the shoulder, and all had recurrent episodes of instability that had failed to respond to a minimum of three months of physical therapy, including short-term immobilization followed by glenohumeral and scapulothoracic muscle-strengthening. The mean time between the injury and the surgery was thirty-six months (range, three to 360 months).

Radiographic Evaluation

Anteroposterior, axillary, West Point[45], and Stryker notch[23] radiographs had been made of all shoulders, and several patients had had either a computerized tomography scan with intra-articular contrast medium or a magnetic resonance imaging study with intra-articular contrast medium. Twenty-six patients had documented evidence of a Hill-Sachs lesion. The presence or size of a Hill-Sachs lesion, however, was not used as a criterion in determining the suitability for an arthroscopic or open stabilization. Some of these studies showed a discrete Bankart lesion, and some showed marked capsular redundancy.

Examination Under Anesthesia

Examination under anesthesia was performed with a method that we modified from that of Altchek et al.[1] and that was described previously[58]. The shoulder was examined for anterior, posterior, and inferior translation. Inferior translation was measured by applying a distraction force to the adducted shoulder and measuring the amount of movement of the humeral head by estimating the acromiohumeral distance. A scale of 0 to 3+ was utilized, with 0 indicating no movement; 1+, movement of one centimeter inferiorly; 2+, movement of two centimeters inferiorly; and 3+, movement of three centimeters inferiorly. Anterior and posterior translation was measured with the shoulder abducted to 90 degrees and held in the plane of the scapula with the humerus externally rotated about 70 degrees. An axial load was applied down the humeral shaft with one hand while the other hand applied an anterior or posterior drawer. The magnitude of translation was measured on a scale of 0 to 3+, with 0 indicating no translation; 1+, trace movement on the glenoid; 2+, translation of the humeral head to the edge of the glenoid; and 3+, translation of the humeral head over the glenoid.

Patients who were found to have inferior translation of 2+ or 3+ in addition to anterior translation of 2+ or 3+ were selected for an open capsular shift as we thought that this represented substantial inferior capsular laxity. Patients with anterior translation of 2+ or 3+ but inferior translation of 1+ or less were selected for an arthroscopic Bankart repair when labral tissue permitted as we thought that this represented instability without major capsular laxity.

Arthroscopic Evaluation

At the time of arthroscopy, the joint was inspected for evidence of substantial articular injury, concomitant injury of the biceps origin, or a rotator cuff tear. Additionally, the anteroinferior aspect of the labrum was evaluated, and the presence of a Bankart lesion was noted. Capsular laxity or injury was assessed with several methods. Direct inspection of the capsule determined if the glenohumeral ligaments were well formed band-like structures or if there was thin, patulous tissue with poorly defined glenohumeral ligaments (that is, a lack of any visible capsular thickening in the region of the inferior glenohumeral ligament complex). This method for assessment of the glenohumeral ligaments has been employed previously and has been shown to be valid and reproducible both clinically and experimentally[4,27,38,54,57]. Patients who had capsular rupture or who had thin capsular tissue without discrete ligaments were selected for an open anteroinferior capsular shift procedure. In addition, any patient with combined capsular laxity and a Bankart lesion was selected for an open anteroinferior capsular shift procedure. Patients who had a discrete Bankart lesion and well formed glenohumeral ligaments were selected for an arthroscopic Bankart repair.

Surgical Procedures

Thirty-nine patients were determined to be suitable candidates for arthroscopic repair, and twenty-four were selected for anteroinferior capsular shift. Two patients in each group could not be reached for follow-up and were not included for purposes of analysis.

The two groups were comparable in terms of age (a mean of twenty-eight years in the arthroscopy group and twenty-seven years in the open-repair group); interval from injury to surgery (a mean of thirty-five months in the arthroscopy group and forty-seven months in the open-repair group); follow-up interval (a mean of fifty-two months in the arthroscopy group and fifty-five months in the open-repair group); the percentage of operations performed on the dominant side (49 percent in the arthroscopy group and 36 percent in the open-repair group); gender; and prevalence of dislocation compared with subluxation. The groups were generally comparable with respect to the etiology of the instability, except that there was a greater preponderance of work-related incidents in the arthroscopically treated group (Table I).

Arthroscopic Bankart Repair

Arthroscopic Bankart repair was performed with use of absorbable transfixing implants (Suretac; Smith and Nephew Endoscopy,

TABLE II
RESULTS AT THE TIME OF FOLLOW-UP

Variable	Arthroscopy Group*	Open-Repair Group*	P Value†
No. of patients	37	22	
Recurrent dislocation or subluxation	6 (16%)	2 (9%)	0.697
Apprehension	3 (8%)	2 (9%)	1.000
Unsatisfactory result‡	9 (24%)	4 (18%)	0.749
Reoperation	2 (5%)	1 (5%)	0.624
Mean Rowe score *(points)*	83	82	NS
Excellent	23 (62%)	13 (59%)	NS
Good	5 (14%)	4 (18%)	NS
Fair	7 (19%)	5 (23%)	NS
Poor	2 (5%)	0	NS
Mean ASES§ score *(points)*	87	88	NS
Range-of-motion deficit# *(degrees)*			
Forward elevation	−3 ± 5.5	−7 ± 5.5	0.05
External rotation at side	−9 ± 12.0	−11 ± 10.0	NS
External rotation at 90 degrees of abduction	−6 ± 7.7	−8 ± 9.6	NS
Internal rotation at 0 degrees of adduction	<1 vertebral level	<1 vertebral level	NS
Patient satisfied	31 (84%)	20 (91%)	NS
Return to sports			NS
No limitations	17 (46%)	11 (50%)	
Mild limitations	11 (30%)	6 (27%)	
Moderate limitations	5 (14%)	4 (18%)	
Severe limitations	0	1 (5%)	
Unable	4 (11%)	0	

*The values are given as the number of patients unless otherwise indicated.
†NS = not significant.
‡A result was considered unsatisfactory if there was recurrence or apprehension.
§ASES = American Shoulder and Elbow Surgeons.
#The deficit was calculated by subtracting the motion of the treated shoulder from that of the contralateral shoulder. The values are given as the mean and the standard deviation.

Mansfield, Massachusetts). Our method of repair has been described previously and includes an anatomical repair of the surgically mobilized Bankart lesion with arthroscopic placement of two or three implants through the labrum and into the glenoid margin[58].

Open Anteroinferior Capsular Shift

The open capsular shift technique that we use is a modification of the capsular shift described by Neer and Foster[37]. Through a deltopectoral approach, a laterally based capsulotomy is performed and the Bankart lesion is repaired medially through this capsulotomy. The method includes incising the capsule transversely and translating the inferior capsular flap superiorly and slightly laterally and translating the superior capsular flap inferiorly and slightly laterally; this is termed a selective capsular shift[58].

Aftercare

After both types of treatment, the patient keeps the arm in a sling for four weeks. Sling removal is permitted for bathing, although active-assisted range of motion is delayed for four weeks. Strengthening begins as soon as the patient recovers sufficient motion to perform activities of daily living. At four months, the patient is permitted to throw a ball or swim, but contact and collision sports are delayed until the eighth postoperative month.

Operative Findings

All thirty-seven patients undergoing arthroscopic Bankart repair were found to have a discrete Bankart lesion with well defined glenohumeral ligaments and capsular tissue. Of the twenty-two patients who were selected to undergo an open capsular shift, twenty were observed to have patulous redundant or thin capsular tissue with poorly formed glenohumeral ligaments. Two patients had a capsular rupture adjacent to the humeral insertion of the inferior glenohumeral ligament, and thirteen had a concomitant Bankart lesion.

Evaluation

We were able to locate and fully evaluate fifty-nine (94 percent) of the sixty-three patients at a mean of fifty-four months (range, twenty-seven to seventy-two months) after the procedure. Each patient was mailed a questionnaire that fulfilled the requirements of the grading system of Rowe et al.[46,47], the American Shoulder and Elbow Surgeons (ASES) standardized assessment[44], and the acute version of the Short Form-36 (SF-36)[55].

The rating system of Rowe et al.[46,47] was used to evaluate the clinical outcome of the procedure. This 100-point system assigns 50 points for function, 30 points for stability, 10 points for motion, and 10 points for pain. The ASES standardized assessment score is derived from a visual analogue scale for pain (50 points) and a cumulative activities-of-daily-living score (50 points). The acute version of the SF-36 is a reliable and valid generic measure of the health of patients who have a musculoskeletal condition[8,32,55]. It includes a variety of scales measuring physical function, social function, emotional role function, physical role function, mental health, energy, pain, and general health perceptions as well as an overall unweighted mean across dimensions.

Additional questions that were asked addressed the cause of the initial dislocation, the delay prior to surgical treatment, the levels of patient satisfaction and sports participation, the prevalence of subluxation or dislocation after surgery, whether there had been a re-

TABLE III

COMPARISONS BETWEEN ARTHROSCOPIC AND OPEN STABILIZATION IN THE LITERATURE

Study	No. of Patients*	Mean Duration of Follow-up* *(mos.)*	Recurrence Rate* *(percent)*
Field et al. (1999)[15]	50/50	33/30	8/0
Steinbeck and Jerosch (1998)[53]	30/32	36/40	17/5
Guanche et al. (1996)[22]	25/12	27/25	33/8
Geiger et al. (1997)[17]	16/18	23/34	43/0

*Arthroscopic stabilization/open stabilization.

operation after the index procedure, and the presence of pain or apprehension.

The fifty-nine patients were evaluated by an examiner who was not the surgeon and who was blinded to the side and method of the surgery; fifty-seven patients were examined by one of us (B. J. C.) and two, by a shoulder specialist in the patient's local community who had been briefed about the procedure. In order for the examiner to remain blinded, the patients were instructed to wear a shirt and to not indicate which shoulder had undergone repair. Thirty-one patients were examined in the physician's office, and the remaining twenty-eight were evaluated in their home or place of work. Physical examination consisted of measurement of the range of motion (forward elevation, external rotation in adduction and abduction, and active internal rotation) with a goniometer and evaluation for the presence of apprehension.

The apprehension sign was assessed with the patient supine and the arm externally rotated, abducted, and extended. The relocation maneuver was performed by applying a posteriorly directed force to the humerus of the abducted and externally rotated arm. The apprehension test was considered positive if the patient reported feeling apprehension or withdrew from the examiner when the arm was placed in the apprehension test position. A positive relocation sign consisted of complete relief of apprehension with posterior pressure on the humerus[29,51].

Statistical analysis was performed with SPSS 7.5 software (SPSS, Chicago, Illinois). Specific analyses included the chi-square test for frequency data and independent t tests for continuous data.

Results

The results for the fifty-nine patients who underwent complete evaluation are shown in Table II.

Excluding recurrent instability, the only complication of treatment occurred in a patient who had undergone an arthroscopic Bankart procedure and fell in the early postoperative period. Adhesive capsulitis developed but resolved with physical therapy.

With the numbers available, there was no significant difference between the groups with regard to the prevalence of recurrent instability, apprehension, reoperations, range of motion (except for forward elevation [$p = 0.05$]), Rowe score, ASES score, or return to sports. Comparison with the contralateral shoulder showed that both groups had loss of external rotation with the arm at the side; the loss was 9 ± 12.0 degrees (mean and standard deviation) in the arthroscopy group and 11 ± 10.0 degrees in the open-repair group. There was no significant difference in the scores on the acute version of the SF-36 between the two groups or compared with the general population. Five (14 percent) of the patients in the arthroscopy group and four (18 percent) in the open-repair group reported moderate limitations in their sports activities, and four (11 percent) in the arthroscopy group and one (5 percent) in the open-repair group had severe limitations or were unable to return to their desired sport after surgery.

Analysis of Failures

Patients who had episodes of recurrent instability as well as those with a positive apprehension sign at the final follow-up evaluation were considered to have had a failure of the operation. The overall failure rate was 24 percent (nine of thirty-seven) in the arthroscopy group and 18 percent (four of twenty-two) in the open-repair group. This difference was not significant ($p = 0.749$).

All six episodes of recurrent instability following an arthroscopic Bankart repair were the result of a contact sport or a fall less than two years postoperatively. Five of the six episodes occurred less than one year following surgery. Of the three patients who had a positive apprehension and relocation sign following an arthroscopic Bankart procedure, only one had the subjective impression that he had an unstable shoulder. None of these three patients felt limited in their daily activities. Two of the six patients with recurrent instability underwent a revision open capsular shift procedure and had a good result according to the Rowe criteria. Both were found to have a lax capsule and no Bankart lesion. The four patients who did not elect to have revision surgery had a fair result according to the Rowe criteria.

Two patients had a recurrent dislocation less than one year after an open capsular shift procedure. One patient underwent a revision capsular shift procedure and was found to have a lax capsule and no Bankart lesion. Two patients had apprehension after an open repair, but only one felt subjectively that the shoulder was unstable.

Discussion

Many studies[6,27,38,54,57] have shown a spectrum of capsulolabral injury as a result of anterior shoulder dislocation. The present study demonstrated that, if one selects patients for arthroscopic Bankart repair or open capsular shift on the basis of the operative findings of capsulolabral injury, the results of the two procedures can be equivalent. Patients were selected with use of specific criteria that did not change during the period of this study. These criteria were based both on biomechanical

observations of the factors that lead to instability and on clinical impressions of the importance of capsular laxity and labral detachment in the etiology of instability. Although our study groups were not comparable in terms of capsulolabral pathology, they were comparable with regard to etiology, age, and chronicity of the instability.

Arthroscopic stabilization will always be compared with what many believe is the standard treatment — that is, open stabilization. The lowest recurrence rates following arthroscopic stabilization in studies with satisfactory follow-up have been 4 to 8 percent[3,13,36,62]. Most other series reflect the difficulty in reproducing these results. Open reconstruction is a versatile procedure capable of addressing detachment lesions and capsular pathology when necessary. Rowe et al.[46] reported a 97 percent success rate with open Bankart repair (five recurrences in 143 shoulders). Many other studies on open Bankart reconstruction have demonstrated success rates ranging from 91 to 97 percent[1,15,28,30,37,39,46-48,61]. However, the results in terms of return to high-level activities have been less promising following open stabilization. For example, Bigliani et al.[11] noted that only 67 percent (forty-two) of sixty-three throwing athletes returned to their normal activity level following an open capsular shift procedure. Of even more concern are reports of motion loss following open stabilization[25,26].

Although other studies have demonstrated similar failure rates, we are unaware of any that compared groups using the Rowe score, the ASES score, and the SF-36 as we did. Furthermore, we evaluated our patients in an independent blinded fashion that should have eliminated observer bias as a confounding variable.

We found that the rate of recurrent instability following arthroscopic Bankart repair was actually lower than that found in many reports[14,18,20,24,31,33,35,41-43] while the rate after open capsular shift was somewhat higher[1,15,28,30,37,39,40,46-48,61]. This finding may be due to the activity level of our patients, since all recurrences resulted from a traumatic event following surgery. Of particular interest was the observation that some of our patients who had apprehension did not have any subjective sense of instability. Thus, it is possible that other investigators underestimated the true prevalence of recurrence because the follow-up did not include a careful examination for apprehension.

There are only a few reports in which the results of arthroscopic and open stabilization are compared in a relatively pure population of patients with traumatic anterior instability (Table III). Field et al.[16] compared the results following arthroscopic placement of suture anchors with those following open Bankart repair. Steinbeck and Jerosch[53] compared transglenoid stabilization with open anchor stabilization. Guanche et al.[22] reported on the use of both transglenoid sutures and suture anchors as compared with the use of open Bankart repair. Finally, Geiger et al.[17] compared arthroscopic transglenoid suture placement with open stabilization. When the recurrence rate was the primary outcome measured, all of these series demonstrated trends or significant differences favoring open repair over arthroscopic stabilization.

The aforementioned studies compared a consecutive series of patients treated with an open procedure with a consecutive group treated with an arthroscopic procedure; no effort was made to optimize the indications for either treatment on the basis of individual pathoanatomy. In contrast, the aim of our study was to define two different subgroups of patients, all diagnosed with traumatic anterior shoulder instability, and to determine the better procedure on the basis of the specific pathoanatomy identified at the time of surgery.

Limitations of this study are comparable with those of other nonrandomized studies evaluating these techniques. Despite our attempts to identify a truly homogeneous population, we did not perform a truly randomized prospective study with an absolutely pure patient population to compare arthroscopic and open stabilization techniques. We sought to optimize the indications for each technique in order to improve their respective outcomes.

Our technique of arthroscopic Bankart repair involved use of absorbable transfixing devices, and it may not be appropriate to compare these results with those in series in which suture repair techniques were used. Because our chosen method is essentially equivalent to single-point fixation, the degree of capsular tightening was probably minimal. It is of particular interest that range of motion and return to sports did not differ between our two treatment groups.

Refining selection criteria on the basis of the pathological findings at the time of surgery for recurrent traumatic shoulder instability, rather than treating all patients with a single reconstruction technique, should reduce the failure rates following arthroscopic stabilization. We concluded that arthroscopic Bankart repair and open capsular shift for the treatment of traumatic, recurrent anterior instability achieve a similarly high degree of success and patient satisfaction when the criteria for selecting either procedure are carefully considered. Consistent selection based on intraoperative examination and arthroscopic inspection of capsulolabral injury to optimize the indications contributed to successful treatment.

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