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SYMPOSIUM: ARTHROSCOPY

Is Selective Arthroscopic Revision Beneficial for Treating Recurrent Anterior Shoulder Instability?

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Abstract

Background Surgeons have traditionally treated recurrent shoulder dislocation by open methods. With the advent of arthroscopic repair techniques some surgeons reported higher recurrence rates than with open methods but some of those reports included patients with a variety of problems, including bone loss and those continuing in contact sports. It is unclear whether recurrence rates would be higher in patients without bone loss and those willing to forego contact sports.

Questions/purposes We therefore determined recurrence rates and functional scores after arthroscopic revision shoulder stabilization in patients without bone loss and those not subsequently participating in contact sports.

Patients and Methods We retrospectively reviewed 16 patients who underwent a revision arthroscopic Bankart repair using suture anchors. An arthroscopic approach was selected in patients with a unilateral traumatic injury and mild to moderate bone loss. Arthroscopic stabilization was contraindicated in patients with (1) multidirectional shoulder instability; (2) greater than 25% glenoid bone loss; (3) a Hill Sachs lesion involving more than one-third of the articular surface of the humeral head; and (4) patients electing to continue pursuing contact sports. At followup, physical examination of both shoulders was conducted. Several functional scores (Rowe, UCLA, and Constant & Murley) were compiled. The minimum followup was 24 months (mean, 31 months; range, 24–46 months).

Results The UCLA score (22–31), Constant & Murley score (69–80), and Rowe score (33–80) all improved. Shoulder instability recurred in three of the 16 patients, two sustaining dislocations and one a subluxation. One recurrence was the result of new trauma and this patient underwent an open Latarjet procedure; the other two patients refused further surgery.

Conclusions Revision arthroscopic Bankart repair using suture anchors was associated with a low recurrence rate and restoration of acceptable function in patients without bone loss and not participating in contact sports.

Level of Evidence Level IV, therapeutic study. See Guidelines for Authors for a complete description of levels of evidence.

Introduction

Open repair techniques for treating failed anterior shoulder instability have been the gold standard and offered acceptable functional results. A number of studies of open stabilization have reported a lower recurrence rate when compared with arthroscopic techniques [7, 8, 13, 21, 31, 33]. However, more recently, arthroscopic shoulder stabilization has been advocated with comparable recurrence rates to those of open repair [4, 14, 15, 25]. Nonetheless, recurrence of anterior shoulder instability after open or arthroscopic soft tissue repair continues to occur with a range of 5% and 15%. Usually, these failures are associated

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with nonanatomic repairs, the presence of substantial bony glenoid defects, engaging Hill-Sacks lesions, or repeat trauma [3, 12, 16, 18, 22–24, 28]. When revising a previous arthroscopic instability repair, the surgeon is faced with the following dilemma: either to perform an open repair technique in an attempt to minimize the chance of recurrence or perform an arthroscopic repair aiming to minimize soft tissue damage and enable the patient to regain as much function as possible. We presumed the recurrence rate after revision arthroscopic and open instability repairs would be similar in the absence of glenoid or humeral bone loss and if the patient was willing to avoid contact sports.

We therefore determined the: (1) intra-articular findings; (2) rate of recurrent instability, and (3) function in patients without bone loss and those willing to avoid contact sports.

Patients and Methods

In a 3-year period (2004–2007), 24 patients underwent revision repair for recurrent anterior shoulder instability after a failed initial surgery. Sixteen procedures were performed arthroscopically and constituted the group identified for analysis. The mean age was 26.8 ± 7.7 and 82.5% were males (Table 1). Eleven patients had anterior shoulder instability on their dominant side and five on the nondominant one. No patients were lost to followup. No patients were recalled specifically for this study; all data was obtained from medical records and radiographs. The minimum followup was 24 months (mean, 30.9 months; range, 24–46 months).

A single previous failed surgery had been performed in 12 patients, whereas the remaining four patients had experienced two previous failed surgeries. Of these 20 previous instability procedures, 14 were performed arthroscopically and six open. Index arthroscopic techniques to repair the anterior capsulolabral tissue included six transglenoid repairs, two capsular repairs using staples, and six using suture anchors. Thermal shrinkage of the capsule was an ancillary procedure used in four cases. Open techniques consisted of four Bankart repairs and two unspecified "capsular shifts." Based on the arthroscopic findings, we judged the cause of failure for 12 of the 16 patients to be a result of suboptimal surgical technique. The primary reason for failure in four patients was a new episode of trauma. An arthroscopic approach was chosen for patients with a unilateral traumatic injury and mild to moderate bone loss. This procedure was contraindicated in patients with (1) multidirectional shoulder instability (defined as subluxations or dislocations in more than one direction); (2) greater than 25% bone loss at the glenoid surface [5]; (3) a Hill Sachs lesion involving more than one-third of the articular surface of the humeral head [5]; or (4) those who were unwilling to discontinue contact sports. The presence of an engaging Hill Sachs lesion by itself was not considered an absolute contraindication for an arthroscopic approach. However, whenever the dislocation was reproduced with the shoulder in less than 45° of abduction

Table 1. Baseline characteristics

Case number	Age (years)	Gender	Dominant limb	Main sport	Prior surgeries	Followup (months)	Positive apprehension test	Rowe rating
1	24	Female	Yes	Tennis	Transglenoid	29	N	Good
2	27	Male	No	Soccer	Transglenoid	32	N	Good
3	16	Male	Yes	Volleyball	Staples + open	43	Y	Fair; subluxations
4	34	Male	Yes	None	Suture anchors	25	N	Excellent
5	21	Male	No	Soccer	Suture anchors	31	N	Excellent
6	32	Male	Yes	Tennis	Suture anchors	24	N	Excellent
7	18	Female	No	Soccer	Transglenoid	26	N	Excellent
8	32	Male	Yes	Tennis	Suture anchors	25	N	Excellent
9	35	Male	Yes	None	Staples + open	28	N	Excellent
10	27	Male	No	Soccer	Transglenoid + open	37	Y	Fair; dislocations
11	32	Male	Yes	Golf	Suture anchors	46	N	Excellent
12	17	Male	Yes	Soccer	Suture anchors	26	N	Good
13	32	Male	Yes	Ski	Open	36	N	Excellent
14	22	Male	No	Soccer	Transglenoid + open	29	Y	Fair; dislocations
15	18	Male	Yes	Tennis	Transglenoid	31	N	Excellent
16	42	Female	Yes	Tennis	Open	27	N	Good

N = no; Y = yes.

and less than 45° of external rotation, open surgery was deemed necessary.

Bone deficiency was preoperatively evaluated with standard AP radiographs in neutral, internal, and external rotation in the plane of the glenoid and an axillary lateral view. In addition, CT scans in oblique, coronal, and sagittal orientations were performed in all cases to assess bone defects of the inferior third of the glenoid and the upper half of the humeral head. The percentage of glenoid and humeral head bone loss was determined by comparing similar sections with the normal contralateral side.

Even if an arthroscopic approach was clinically indicated, the findings observed during both the shoulder examination under general anesthesia and at diagnostic arthroscopy were considered vital in selecting the most appropriate surgical approach.

During the diagnostic arthroscopy, bone loss at the inferior third of the glenoid was assessed with a caliper. The distance from the central bare spot to the intact posterior rim provided the length of the normal radius. The difference between the radius and the length from the bare spot to the remaining anterior glenoid margin was used to determine the width of the glenoid defect. By comparing the defect size with the estimated diameter (twice the radius), the percentage of bone loss was calculated. A Hill Sachs lesion was not considered a contraindication for arthroscopic soft tissue revision if the defect only involved the posterosuperior aspect of the humeral head and was oriented horizontally.

Tissue quality was defined satisfactory or poor based on the degree of humeral head translation during examination under general anesthesia and by its appearance during arthroscopy. The amount of tissue laxity was assessed during translation testing (anterior, posterior, and inferior sulcus), which is a good diagnostic indicator of shoulder instability. We graded translation according to the method of Terry et al [32]. Translation was classified into categories ranging from no movement to frank dislocation based on the perceived position of the center of the humeral head in relation to the glenoid rim.

Patients with Grade III translation (presence of humeral head translation beyond the glenoid rim) [32] combined with a large vertical Hill Sachs lesion were considered at high risk for failure of an arthroscopic approach and were scheduled for an open reconstruction.

A single surgeon (GA) performed all of the surgeries. All patients underwent general anesthesia and were placed in the lateral decubitus position with the arm suspended in 60° of abduction and 30° of forward flexion. One posterior and two anterior portals were used. The posterior portal was placed lateral enough to have good access to the posterior inferior labrum and inferior enough to provide access to the axillary pouch. The surgical technique was tailored to the intraoperative findings. The glenoid neck was débrided to enhance healing (Fig. 1). Anchors were introduced through the anteroinferior portal and positioned on the face of the glenoid to reproduce the bumper effect of the labrum and restore the seal around the glenoid. An extensive Bankart repair with anterior capsular plication was performed in all cases (Fig. 2). Single- or double-loaded suture anchors were used to refix the labrum and create the anterior capsular plication. An average of 4.5 anchors was used per case. Anchors were placed at the cartilage margin from 1 to 6 o'clock except in cases creating a posteroinferior capsular plication wherein an anchor

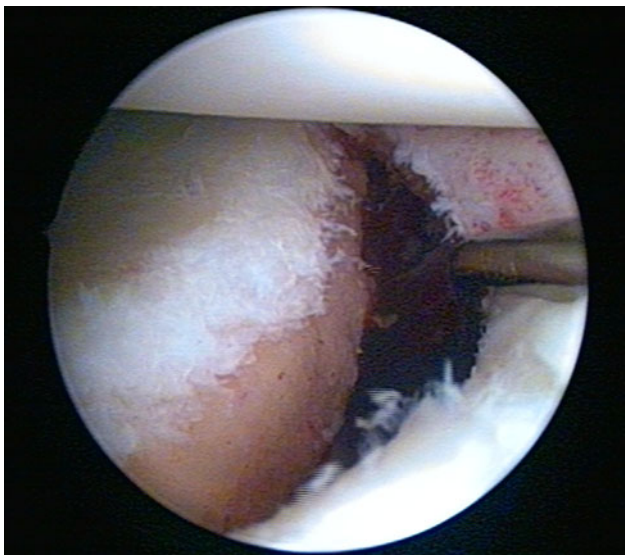

Fig. 1 Arthroscopic image showing thorough débridement of the glenoid neck to promote adequate healing response.

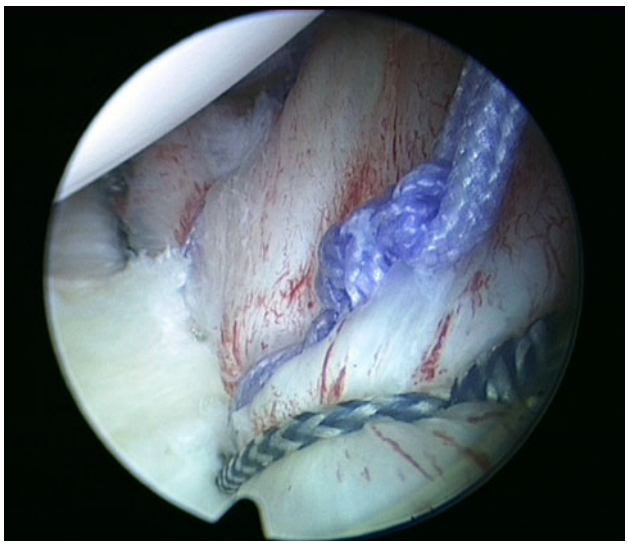

Fig. 2 Arthroscopic image showing an extensive Bankart repair and capsular plication with double-loaded anchors.

was also placed at 7 o'clock. In seven cases, the surgeon reported difficulties with anchor placement as a result of the location of previously placed hardware. In those instances, anchors were removed when possible. The rotator interval was closed at the end of the procedure in all cases using two vertical nonabsorbable sutures introduced between the superior and middle glenohumeral ligaments (SGHL and MGHL, respectively). The rotator interval closure technique was as follows: a spinal needle was introduced through the anteroinferior portal penetrating the MGHL and capsule just superior to the subscapularis tendon. A monofilament suture was then threaded into the glenohumeral joint. Subsequently, a tissue penetrator was delivered through the anterosuperior portal to pierce the SGHL and capsule just anterior to the leading edge of the supraspinatus tendon. The monofilament suture was then retrieved with the tissue penetrator, withdrawn though the anterosuperior portal, and used to shuttle a braided nonabsorbable suture through the capsular tissues. A knot pusher was threaded over the inferior limb of suture, passed through the anteroinferior portal to the level of the capsule, and then used to deliver the suture for retrieval out the anterosuperior portal. Under direct arthroscopic visualization, tension was applied to the suture to draw the SGHL and the inferior rotator interval tissue together, thus revealing the extent of the rotator interval closure.

A posteroinferior capsular plication was performed in cases (N = 14) when the posterior band of the inferior glenohumeral ligament and the inferior capsular pouch were elongated (Fig. 3).

A stepwise rehabilitation program was begun after 4 weeks of immobilization in a Velpeau dressing, which was removed only for showering and personal hygiene needs. A supervised physical therapy program focused on deltoid, cuff, and periscapular muscle strengthening. ROM exercises avoiding external rotation were recommended for an additional 4 weeks. Full ROM was permitted 8 weeks after surgery and a gradual return to sports was allowed 6 months after the revision procedure.

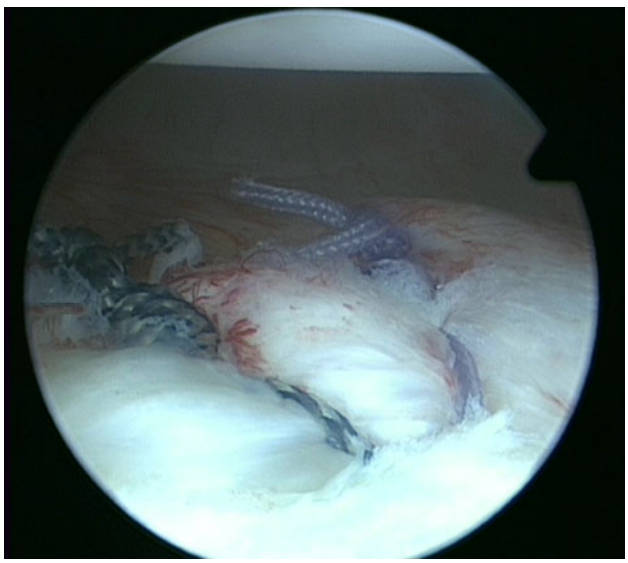

Fig. 3 Arthroscopic view showing a posteroinferior capsular plication for inferior glenohumeral ligament laxity.

A single investigator (DF), who was not the treating physician, examined all patients before surgery and during followup evaluations. Patients were not specifically recalled for the present study; data were collected from a review of the medical records and radiographs. No patients were lost to followup.

ROM in all planes and manual strength testing were performed. Passive ROM was compared with the opposite normal side. In addition, the presence of an apprehension sign in abduction and external rotation was sought and the relocation test performed. Inferior translation as a sign of capsular laxity was evaluated using the sulcus sign. External rotation was measured with the arm at the side using a goniometer. All patients underwent clinical assessment with three validated scores (UCLA [19], Constant & Murley [9], and Rowe [19]). Pain was evaluated using UCLA and Constant & Murley scores. The definition of a painful shoulder was used when patients have less than 6 points on the UCLA and less than 10 points on the Constant pain rating scales. We recorded whether they returned to sports, the time interval, and the level of competition. All statistical analyses were performed using the SPSS 17.0 software package (SPSS Science, Chicago, IL). Results are reported as mean values and as the standard error of the mean. We used the Wilcoxon test to evaluate the difference between patient responses for all scores during the preoperative and postoperative periods.

Results

Shoulder instability recurred in three of the 16 patients. Two sustained an anterior dislocation and the third a shoulder subluxation. One of the dislocations occurred after a new traumatic event and that patient underwent an open Latarjet procedure. The other two patients with recurrent instability presented with symptoms between 12 and 18 months after the revision surgery and elected not to pursue further surgical treatment. All three patients had pain before revision but only one had persistent pain after the revision procedure. Eight patients returned to full sports competition after the revision surgery, whereas six patients modified their involvement in sports to a lower level of intensity. Two patients did not pursue any sport activity.

We observed improvement in the UCLA score (22 to 31, $p < 0.001$), Constant & Murley score (69 to 80,

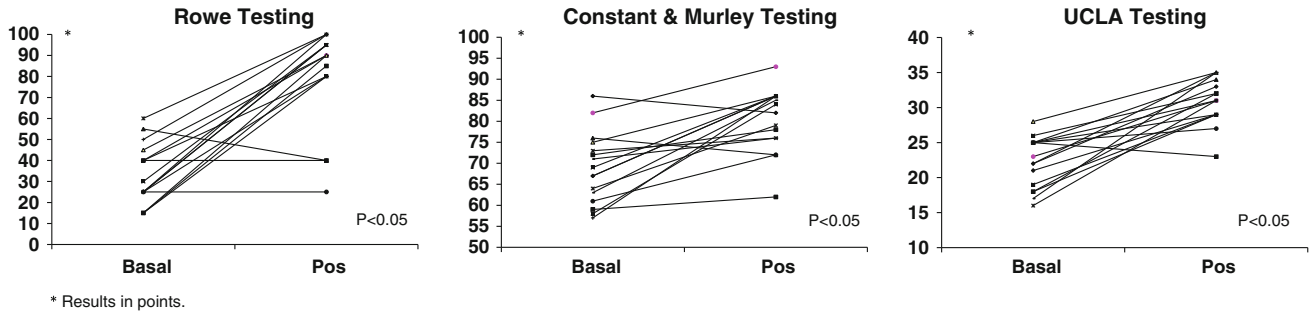

Fig. 4 This figure demonstrates clinical improvement in shoulder function at followup according to three validated scores.

Table 2. ROM at the time of followup

Range of motion	Population (n = 16)
Forward flexion*	160 (range, 135–180)
Abduction*	85 (range, 70 –100)
External rotation in 0° abduction*	45 (range, 15–75)
Loss of external rotation to contralateral side*	15 (range, 0–35)
External rotation in 90° abduction*	80 (range, 65–100)
Internal rotation in 90° abduction	T9 (range, L1–T5)

* In degrees.

$p < 0.001$), and Rowe score (33 to 80, $p < 0.001$) (Fig. 4). According to the Rowe Scale, 81% of the patients achieved good or excellent results.

External rotation (with the arm at the body side) averaged 45° degrees (range, 15°–75°), whereas external rotation at 90° abduction averaged 80° (range, 65°–100°) (Table 2). Loss of external rotation compared with the contralateral side was 15° (range, 0°–35°). Only two patients had more than a 30° restriction of external rotation in adduction. Average forward flexion was 160° (range, 135°–180°) with internal rotation to T9 (range, L1–T5). The apprehension sign was positive in three patients. Mild or moderate pain (UCLA questionnaire) was present in four patients (25%).

Discussion

Most surgeons have treated recurrent shoulder dislocation by open methods. The advent of arthroscopic repair techniques allowed avoidance of the morbidity of open methods, but some reports suggest higher recurrence rates than with open methods. However, those reports included patients with bone loss and those continuing in contact sports. Because it was unclear whether recurrence rates would be higher in patients without bone loss and those willing to forego contact sports we determined recurrence rates and functional scores after arthroscopic revision shoulder stabilization in patients without bone loss and those not subsequently participating in contact sports.

Our study is subject to a number of limitations. First, it is a small observational study with only 16 patients. However, the indications for this procedure are limited, the procedure fairly recent, and we required a two-year minimum followup. Nonetheless, the data provide some indication of the recurrence rates and function. Second, we had no control group of alternative approaches, particularly an open approach, in patients with similar indications and contraindications. Third, given the small number of patients we were unable to identify any pre- or intraoperative factors that may have predicted a poor outcome. Nonetheless, all patients whose revision arthroscopic stabilization failed had two prior surgeries, which may have affected bone and soft tissue quality, available sites for anchor placement, and possibly patient compliance, all factors potentially resulting in increased complexity of the cases.

We found arthroscopic revision shoulder stabilization in patients with the stated indications was associated with recurrent dislocation in three of 16 patients. Patient function and quality-of-life scores improved in most patients at last followup. However, residual pain occurred in four of the 16 patients. Therefore, it appears advisable to warn patients about the potential for residual pain after revision surgery. Arthroscopic findings showed that for 12 of the 16 patients, the index stability procedure likely failed as a result of surgical errors. Thus, we believe appropriate patient selection and good surgical technique are essential to achieve a satisfactory surgical result. Our data are comparable to those in previous reports (Table 3). Kim and Ha [17] prospectively evaluated 23 patients who underwent arthroscopic revision stabilization using a suture-anchor technique. Five patients (22%) experienced recurrent instability after revision with those failures correlated with a return to contact sports. Neri et al. [26] reported a recurrence rate of 27% (three of 11) at 34 months when using a capsulolabral suture anchor repair to treat anterior

Table 3. Summary of reported results of arthroscopic revision stabilization

Study	Number	Followup (months)	Mean UCLA followup (months)	Mean Rowe followup (months)	Mean visual analog scale followup	Apprehension (%)	Recurrence rate (%)
Barnes et a.l (2009) [1]	16	38	NA	83.5	NA	NA	6
Boileau et al. (2009) [2]	22	43	29.5	81	1.1	11	5
Franceschi et al. (2008) [14]	10	68	31.7	NA	NA	NA	10
Kim and Ha (2002) [17]	23	36	33.2	91.2	0.8	8.7	21.7
Millar and Murrell (2008) [25]	10	37	31	93	1.2	10	30
Neri et al. (2007) [26]	11	34	No	74.5	NA	9	27
Patel et al. (2008) [27]	40	34	NA	NA	NA	NA	10
Creighton et al. (2007) [10]	18	29	NA	91	2	NA	17

NA = not available.

shoulder instability. Most of the patients had the addition of a rotator interval closure. Another study reported the results in 18 patients who had a revision arthroscopic stabilization. At 30 months, repair failed in five patients (28%), two with ongoing pain and three with recurrent instability [6, 10]. Boileau et al. [2] published their results of arthroscopic revisions in 22 patients with good and excellent outcomes in 85% of the cases using the Walch-Duplay rating scale [11]. One patient (5%) sustained recurrent subluxations and five (22%) had persistent apprehension. Patel et al. [27] reported on the results of 40 patients undergoing arthroscopic revision surgery who had a mean followup of 36 months. Recurrent anterior shoulder instability persisted in only four patients (10%). In a retrospective review, Barnes et al. [1] also demonstrated a low failure rate (6% [one of 16 shoulders]) at 38 months followup. A recent study compared primary arthroscopic shoulder stabilization with arthroscopic revision (n = 20). No one in either group had recurrent instability, but the revision group had poorer functional outcomes (Walch-Duplay score, Rowe score, and Western Ontario Shoulder Instability Index) than the primary stabilization group [20].

Several investigators have shown that diagnostic errors (ie, failure to recognize glenoid bone loss [5] or Hill Sachs lesions [5], hyperlaxity, poor tissue quality, associated injuries, and poor postoperative patient compliance) and technical mistakes (ie, creating a nonanatomic repair resulting from suboptimal suture anchor placement or inadequate capsular tensioning) occur frequently in patients with recurrent instability [3, 22, 24, 28, 31]. Consequently, in an attempt to minimize recurrent instability after revision, we focused on two basic concepts: (1) appropriate patient selection and (2) optimal surgical technique. In our study, strict inclusion criteria for arthroscopic revision were implemented, carefully selecting patients with mild or moderate bone loss, no hyperlaxity, a willingness to comply with the postoperative rehabilitation protocol, and a firm commitment to avoid contact sports. Displaced or malunited fractures of the glenoid rim are commonly encountered during revision stabilization. Sugaya et al. [29, 30] demonstrated that the incorporation of residual bone fragments during the repair improved their long-term results. Accordingly, remaining glenoid bone segments were always included in the reconstruction in our study.

Arthroscopic Bankart revision using suture anchors, although challenging, can result in a low recurrence rate and a reliable functional result in carefully selected patients, although four of out 16 patients had residual pain. The data allow surgeons to better counsel patients without bone loss and willing to give up contact sports about the likelihood of recurrent dislocation, function, and pain.

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