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Results of Arthroscopic Bankart Repair for Anterior-Inferior Shoulder Instability at 13-Year Follow-up

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Background: Anterior-inferior shoulder instability is a common injury in young patients, particularly those practicing overhead-throwing sports. Long-term results after open procedures are well studied and evaluated. However, the long-term results after arthroscopic repair and risk factors of recurrence require further assessment.

Hypothesis: Arthroscopic Bankart repair results are comparable with those of open repair as described in the literature.

Study Design: Case series; Level of evidence, 4.

Methods: A total of 180 shoulders with anterior-inferior shoulder instability were stabilized arthroscopically, met the inclusion criteria and the patients were able to be contacted at a minimum of 10-year follow-up. Of these patients, 143 agreed to participate in the study. Assessment was performed clinically in 104 patients using the American Shoulder and Elbow Surgeons score, Constant score, American Academy of Orthopaedic Surgeons score, Rowe score, and the Dawson 12-item questionnaire. The Samilson-Prieto score was used to assess degenerative arthropathy in radiographs available for 100 shoulders. Additionally, 15 patients participated through a specific questionnaire and 24 patients through a telephone survey.

Results: The overall redislocation rate was 18.18%. Redislocation rates for the different types of fixation devices were as follows: FASTak/Bio-FASTak, 15.1% (17/112); SureTac, 26.3% (5/19); and Panalok, 33.3% (4/12). Concomitant superior labral anterior-posterior repair had no effect on clinical outcome. Redislocation rate was significantly affected by the patient's age and duration of postoperative rehabilitation. Redislocation rate tended to be higher if there had been more than 1 dislocation preoperatively ($P = .098$). Severe dislocation arthropathy was observed in 12% of patients, and degenerative changes were significantly correlated with the number of preoperative dislocations, patient age, and number of anchors. The patient satisfaction rate was 92.3%, and return to the preinjury sport level was possible in 49.5%.

Conclusion: Clinical outcome at a mean follow-up of 13 years after arthroscopic repair of anterior-inferior shoulder instability is comparable with the reported results of open Bankart repair in the literature and allows management of concomitant lesions arthroscopically. Modifiable risk factors of postoperative redislocation and arthropathy must be considered. Stabilization after the first-time dislocation achieves better clinical and radiological outcomes than after multiple dislocations.

Keywords: anterior shoulder instability; arthroscopic Bankart repair; long-term results; suture anchors

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Recurrent anterior-inferior shoulder dislocation is one of the most common injuries in athletes.²³ Surgical treatment is generally recommended, especially in young patients due to the high redislocation rate after nonoperative treatment.^{16,30}

Reports on open Bankart repair have shown high success rates in the long term, with redislocation rates that may be less than 5%.^{12,17} However, arthroscopic Bankart repair has gained more popularity in recent years due to its lower complication rate, faster and easier postoperative rehabilitation, and comparable results in midterm studies compared with open repair.^{1-4,12,15,17}

Furthermore, recent technical advances resulting in improved ability to diagnose and manage concomitant lesions allowed arthroscopic stabilization to become the

standard repair technique; however, there remains an ongoing debate regarding the ideal procedure for the overhead and collision athletes.^{19,33}

In the literature, very few studies have evaluated the long-term results after arthroscopic stabilization, and most of them included only small numbers of patients.^{7,10,27,28} Therefore, the aim of this study was to evaluate the long-term results after arthroscopic Bankart repair using the anterior-inferior (5:30 clock position) portal in a large group of patients and evaluate the different risk factors that may be associated with unsatisfactory outcome.

METHODS

For the current study, we included patients with symptomatic anterior-inferior shoulder instability who had an arthroscopic Bankart repair in our department and who were available for follow-up at a minimum of 10 years postoperatively. Exclusion criteria included concomitant rotator cuff tears, bony instability, multidirectional instability, voluntary shoulder instability, and neurologic disorders involving the shoulder girdle. A failed previous Bankart repair, either open or arthroscopic, as well as concomitant superior labral anterior-posterior (SLAP) repairs, were included.

Patients were examined clinically by an experienced orthopaedic surgeon to assess the shoulder stability and evaluate the range of motion. Results were graded according to Hawkins et al.¹³ Patients were assessed using the following measures: American Shoulder and Elbow Surgeons (ASES) score, Constant score, Rowe score, Dawson 12-item questionnaire, and American Academy of Orthopaedic Surgeons (AAOS) score. Strength was measured for the Constant score using a strength measurement device (Isobex 3.0; Primatron AG).^{8,9,13,20,22,29,31}

A visual analog scale (VAS) for pain, a VAS for instability, subjective satisfaction of patients with the results, and a sport activity questionnaire (including level, frequency, and intensity) were obtained.²¹ Radiographs of the shoulder after a minimum of 10 years were assessed for osteoarthritic changes and graded according to the Samilson-Prieto classification.³² The study protocol was approved by the local ethics committee (IRB approval No. 5187/11).

Risk Factors

The following potential risk factors for recurrent instability after arthroscopic anterior-inferior Bankart repair were assessed: age, sex, dominance, number of preoperative dislocations, time interval between the first dislocation and surgery, and number and type of fixation devices used. To decrease the recall bias, data regarding the number of preoperative dislocations and instability interval were retrieved from the department database, collected at an average of 37 months postoperatively.

Surgical Technique and Rehabilitation

All patients were either operated on or directly supervised by the most senior surgeon (A.B.I.). Operative technique

(arthroscopic repair) and the postoperative rehabilitation were performed according to the previously published technique using the deep anterior-inferior portal (5:30 clock position).^{15,33} Three different fixation devices were used: FASTak/Bio-FASTak (n = 112; Arthrex); SureTac (n = 19; Smith & Nephew Endoscopy), and Panalok (n = 12; DePuy Mitek). There was no specific reason for using any of these devices other than the availability of the products in the different time periods of surgery. These products were used sequentially: first the SureTac, then the Panalok, followed by the FASTak, and finally the Bio-FASTak. There was no choice between devices at the time of operation, and the only determining factor on which implant to use was the availability at that time period. The number of devices used and the amount of capsular shift were individualized according to the arthroscopic findings. Arthroscopic SLAP repair was simultaneously performed with 2 anchors, when necessary. Rotator interval closure and capsular plication were also performed using absorbable sutures if needed.^{15,33}

Different rehabilitation protocols were used according to the managing physical therapist, with a standardized scheme for the postoperative range of motion. Patients with dyskinesia, subjective apprehension, or limited range of motion were given longer rehabilitation periods until becoming symptom free.

Statistical Analysis

Statistical analysis was performed using SPSS software version 20 for Mac (SPSS Inc). Normal distribution of data was tested using the Kolmogorov-Smirnov test. For normally distributed data, the *t* test was used. The Mann-Whitney *U* test was used to analyze nonnormally distributed data. Spearman correlation coefficients were calculated to assess correlations between tested risk factors and the different clinical outcome measures. Dichotomous data were computed using the chi-square test. The level of significance was set at $P < .05$.

RESULTS

A total of 180 shoulders that underwent arthroscopic shoulder stabilization for anterior-inferior shoulder instability in our department between December 1996 and March 2001 fulfilled the study inclusion criteria. No open Bankart repairs were performed in the same time period. Of these patients, 143 shoulders (79% follow-up rate) could be recruited and evaluated clinically (104 shoulders), through a specific postal questionnaire (15 shoulders), or through a telephone interview (24 shoulders). The average follow-up was 159.5 months (13.3 years). Five patients (5 shoulders) declined to participate in the study due to variable causes. Five patients (5 shoulders) were deceased (information about the cause of death was not collected), and 27 patients (27 shoulders) could not be reached.

The mean $\pm$ SD age at the first dislocation was 23.49 ± 7.3 years, while the mean age at operation was 28.17 ± 8.3 years. Overall, the redislocation rate was 18.18% (26 shoulders). Fifteen patients (shoulders) reported only a single

TABLE 1
Clinical Outcomes in All Patients at a Mean 13 Years
After Arthroscopic Bankart Repair^a

Outcome Measure	Median $\pm$ SD
Rowe score	90.0 $\pm$ 20.5
Constant score	94.0 $\pm$ 9.1
ASES score	92.0 $\pm$ 17.0
Daily life activity (30 points)	28.0 $\pm$ 6.5
12-item (Dawson)	16.0 $\pm$ 7.2
AAOS	95.0 $\pm$ 9.1
VAS for stability	1.0 $\pm$ 2.3
VAS for pain	0.0 $\pm$ 1.7
External rotation deficit, deg	5.0 $\pm$ 13.4

^aAAOS, American Academy of Orthopaedic Surgeons; ASES, American Shoulder and Elbow Surgeons; VAS, visual analog scale.

postoperative instability episode, described as a dislocation, with a mean VAS for instability of 1.9 out of 10 at follow-up. The overall clinical scores are summarized in Table 1.

Risk Factors for Redislocation

1. Patient Sex and Dominance

No statistically significant difference in redislocation could be found between male (22/107 shoulders [20.56%]) and female patients (4/36 shoulders [11.11%]) ($P = .168$), although it tended to be higher in male patients (male patients have nearly double the redislocation rate of female patients). Redislocation rate was not significantly different between the dominant (20%) and nondominant sides (7.14%) ($P = .288$).

2. Anchor Type

Seventeen of the 112 shoulders that were repaired with the FASTak anchors (15.1%), 5 of the 19 shoulders repaired with the SureTac device (26.3%), and 4 of the 12 shoulders repaired with the Panalok anchors (33%) sustained at least a single postoperative dislocation. However, there was no statistically significant difference between the different anchor types regarding the incidence of postoperative redislocation ($P = .189$), and there was no statistically significant difference between the FASTak and other types of anchors regarding either the incidence ($P = .070$) or the number of postoperative redislocations ($P = .095$).

3. Number of Preoperative Dislocations and Instability Interval

Patients were divided into 3 groups: group A with only subluxations or a single dislocation (41 shoulders), group B with 2 to 5 preoperative dislocations (39 shoulders), and group C with more than 5 dislocations (63 shoulders). After arthroscopic stabilization, group A had a redislocation rate of 9.8% (4 shoulders). In group B, the rate of redislocation increases to 28.2% (11 shoulders), and in group C the rate was 17.4% (11 shoulders). No statistically significant

difference could be found between the different groups ($P = .10$). However, the redislocation rate tends to be higher in patients having more than 1 preoperative dislocation, although this has not proven to be statistically significant ($P = .098$).

The duration of preoperative instability interval did not significantly affect the redislocation rate ($P = .468$).

4. Patient Age

The mean age of patients with postoperative redislocation was 24.8 years at the time of operation. This was significantly lower ($P = .026$) than the mean age of patients without redislocation (28.91 years). Patients were divided into 3 groups: Group A included patients younger than 20 years at the time of operation ($n = 23$: 9 redislocations [39.1%]), group B included patients aged 21 to 30 years ($n = 68$: 11 redislocations [16.1%]), and group C included patients older than 30 years ($n = 52$: 7 redislocations [13.4%]). The redislocation rate drops significantly with advancement of age ($P = .007$).

5. Number of Fixation Devices Used

The number of fixation devices varied from 2 to 6 anchors (without concomitant SLAP repair). Two anchors were used in 16 shoulders (3 redislocations: 18.75%), 3 anchors were used in 63 shoulders (14 redislocations: 22.2%), 4 anchors were used in 52 patients (9 redislocations: 17.3%), 5 anchors were used in 7 patients (1 redislocation: 14.28%), and 6 anchors in 5 patients without any redislocation. No significant difference in the redislocation rate according to the number of the used fixation devices was found ($P = .271$).

6. Duration of Postoperative Rehabilitation

A significant difference in the redislocation rate existed between patients having more and less than 6 months' duration of postoperative rehabilitation ($P = .045$). The prevalence of redislocation in patients with less than 6 months of postoperative rehabilitation was 23.1% ($n = 91$; 21 redislocations), while patients having more than 6 months of rehabilitation had a redislocation rate of only 9.6% ($n = 52$; 5 redislocations).

7. Concomitant SLAP Repair

A SLAP type 5 lesion was identified intraoperatively in 32 of the 143 patients (22.4%) and repaired arthroscopically with 2 additional anchors after Bankart repair. No significant difference in the redislocation rate was observed between patients with SLAP lesions (4/32 patients [12.5%]) and those without (22/111 patients [19.8%]) ($P = .344$).

All clinical scores were not significantly affected by the SLAP repair ($P \geq .33$). The degree of subjective satisfaction (30/32 patients with SLAP lesion were satisfied with the results to different degrees vs 102/111 patients without SLAP lesion) and subjective instability (1.72/10 for patients with SLAP lesion vs 1.99/10 for those without SLAP lesion) were also not significantly better in patients without SLAP repair ($P = .171$ and $.215$, respectively).

TABLE 2
Level of Sport Initially, Preoperatively,
and Postoperatively^a

Participation in Sport	Before First Dislocation	Preoperative	Postoperative
Days/wk	3.12 ± 1.67	1.25 ± 1.61	2.55 ± 1.63
Hours/d	2.42 ± 1.52	1.11 ± 1.29	1.97 ± 1.51
% activity	100	60.80 ± 32.96	84.76 ± 22.77

^aData are reported as mean ± SD.

Subjective Patient Satisfaction

Only 11 patients were unsatisfied with the results of the operative intervention (7.69%), 7 of whom reported a recurrent postoperative dislocation, and 5 that were revised at some point in the postoperative course. Significant difference in satisfaction of patients was associated with the occurrence of postoperative redislocation (7/26 of patients reporting postoperative dislocation were completely unsatisfied with the procedure vs 4/111 patients who did not report a postoperative dislocation) ($P = .001$), subjective sensation of instability (VAS) ($P = .002$), and shoulder pain (VAS) ($P = .024$).

Sport Activity

We were able to evaluate 119 patients regarding sport participation. Of these patients, 59 reported a postoperative return to the same type and level of sport without reduction (49.5%), 36 patients (30.25%) reported reduction in their sport activity, and 24 patients (20.25%) could not return to the same type of sport. Intensity and level of sport initially, preoperatively, and postoperatively are summarized in Table 2.

Prevalence and Risk Factors of Dislocation Arthropathy

Radiographs for 100 shoulders after a minimum of 10 years postoperatively were evaluated using the Samilson-Prieto classification: 31 shoulders did not show any evidence of glenohumeral osteoarthritis, and 28 shoulders showed moderate to severe osteoarthritis. The severity of osteoarthritis was significantly correlated with the number of preoperative dislocations ($P = .016$), older age of patient at the first dislocation ($P = .005$) and at surgery ($P = .002$), and number of anchors ($P = .001$).²⁵

Results in Patients Not Reporting Postoperative Redislocation

A total of 117 patients did not report any postoperative redislocation. The mean age at the first dislocation was 23.84 ± 7.47 years and at operation was 28.99 ± 8.1 years. The mean follow-up duration was 158.8 ± 18.3 months. All postoperative scores show good to excellent median values (Table 3). Patient satisfaction ($P = .002$, $\rho = -0.245$) and

TABLE 3
Clinical Outcomes in Patients Not Reporting
Redislocation at a Mean 13-Year Follow-up^a

Clinical Outcome in Non-redislocators	Median ± SD
Rowe score	90.0 ± 17.5
Constant score	95.0 ± 7.8
ASES score	93.0 ± 17.6
Daily life activity (30 points)	28.0 ± 6.7
12-item (Dawson)	14.5 ± 6.4
AAOS	96.0 ± 9.0
VAS for stability	1.0 ± 1.9
VAS for pain	0.0 ± 1.5
External rotation deficit, deg	4.8 ± 11.7

^aAAOS, American Academy of Orthopaedic Surgeons; ASES, American Shoulder and Elbow Surgeons; VAS, visual analog scale.

the VAS for instability ($P = .000$, $\rho = -0.298$) were significantly correlated with the age of the patient. The mean external rotation deficit was $4.8^\circ \pm 11.7^\circ$.

DISCUSSION

Results of arthroscopic stabilization of anterior-inferior shoulder instability show wide variation when compared with open repair, which is often reported to have lower failure rates but is mostly associated with more limitation of range of motion.¹⁷ This has led to controversy regarding the optimal treatment method, particularly for patients with high functional demands.²⁴

Results of operative shoulder stabilization, whether arthroscopic or open, can be assessed using variable subjective and objective outcomes; however, redislocation was used as the primary outcome measure (including both dislocations that required reduction as well as subluxations when associated with clinical signs of instability). We believe that subjectively reported subluxation or apprehension alone without clinically confirmed signs of instability should not be considered as failure.

In our series, the overall redislocation rate at a mean of 13 years was 18.18% (26 shoulders). Fifteen of the 26 patients (shoulders) reported only a single postoperative dislocation. Most of these did not require reduction through a physician, and none reported any further dislocation. This raises suspicion whether these were a frank dislocation or instead just a subluxation or an episode of apprehension. However, it was extremely difficult to distinguish between these probabilities, and therefore all were considered as failures. This result appears comparable with that of previous studies.^{7,11}

Long-term results after arthroscopic Bankart repair with tacks are generally similar to the results of our group of patients with the SureTak.^{18,23,27} Considering the high redislocation rates with the SureTak and the Panalok systems, which have been attributed to early biomechanical failure, their use in our department was discontinued at an earlier stage.^{5,15,33}

The relatively small number of SureTac and Panalok anchors may not be enough to reach a reliable statistical conclusion, particularly if we take into consideration that they were used at an earlier time point before the introduction and use of (Bio-)FASTak, which may be at least partially attributable to the improvement in the "learning curve."

The long-term redislocation rate after open Bankart repair varies from as high as 58% to as low as 5% and generally is not significantly different from the published results for arthroscopic suture anchors.^{12,14,22}

Our approach for arthroscopic shoulder stabilization is basically similar to other described approaches, except for using the unique deep anterior-inferior portal for anchor placement and capsulolabral repair. We believe that optimal placement of the inferior anchor is only feasible through this portal, although we cannot provide superior clinical outcomes when compared with the current literature.^{10,15,33}

Overall, the number of preoperative dislocations did not affect the redislocation rates. However, a tendency for a higher redislocation rate was observed in patients who were operated on after more than 1 dislocation. This may be attributed to the greater damage to the capsuloligamentous structures, which leads to the use of more anchors and thus a greater amount of foreign material and sutures. The significantly higher prevalence of glenohumeral arthropathy in patients operated on after multiple dislocations leads us to recommend performing surgery after the first dislocation, particularly in young, active patients. This is generally similar to previous studies; however, no statistically significant cut-off value for the number of preoperative dislocations could be found.^{15,28,34}

The high prevalence of SLAP lesions found and managed concomitantly in our group of patients (22.4%) gives an advantage for the arthroscopic over the open repair, where such lesions can be diagnosed and managed. The high prevalence of associated SLAP lesions was also previously reported.³⁶

Age of the patient remains one of the most important nonmodifiable risk factors for recurrent instability. The statistically significant negative correlation found between age and redislocation is similar to what has been reported in the literature.^{15,28}

The number of anchors used was not significantly associated with the redislocation rate. This could be explained by either the small number of patients stabilized with 2 anchors (16 patients) or the fact that those patients receiving only 2 anchors had initially smaller capsuloligamentous lesions. Although a similar result was found by Witney-Lagen et al,³⁵ other studies have shown that using fewer anchors is associated with a higher rate of redislocation.^{4,12} We think that more research is needed to quantify the size of the lesions and establish a rule for the optimum number of anchors needed.

We did not find a significant association between the redislocation rate and sex of patients. Although Porcellini et al²⁶ reported that male sex is a significant risk factor for recurrence, many other long-term studies found no significant difference between males and females.^{6,34}

Return to the preinjury level in athletes practicing higher-level sports was often not possible (in 60% of

patients). The procedure improves the level of sport activity postoperatively compared with the postdislocation condition, and only 20 patients could not return to the same type of sport. Similar results were described in the literature, as return to the preinjury level with open repair was 89% at a mean 13.1 years.¹²

An interesting finding in our study is that the redislocation rate in patients having at least 6 months of postoperative rehabilitation and shoulder-specific exercises was significantly lower (4.5%) than in patients with less than 6 months of rehabilitation (22.48%). To the best of our knowledge, this factor has never been evaluated in the literature. Given the possibility that there are many reasons for a prolonged period of rehabilitation, this point needs further evaluation in future studies to assess if the muscle power gained from the prolonged rehabilitation is the cause for the decreased redislocation rate or if it is simply that these patients have postoperatively tighter shoulders that required a prolonged rehabilitation to improve the range of motion.

With an overall subjective satisfaction rate of 92.3% and a redislocation rate of 15.1% for the currently used suture anchors at a mean follow-up of 13 years, we conclude that the long-term results after arthroscopic Bankart repair are comparable with those after open repair. This is also confirmed by Chalmers et al.⁷

Weaknesses in our study include its retrospective design with no available preoperative clinical scores, as well as the different group sizes of the different types of fixation devices. Strengths include the large number of patients and the long duration of follow-up, as well as the clinical and radiological examination.

CONCLUSION

The long-term follow-up after arthroscopic Bankart repair shows a favorable outcome, with a redislocation rate comparable with that of open repair results as described in the literature, along with a high degree of patient satisfaction. Patient age and duration of rehabilitation affect the clinical outcome, whereas older age, increased number of preoperative dislocations, and an increased number of fixation devices used negatively affect the radiological outcome.²⁵ Reducing the number of preoperative dislocations, thus likely reducing the degree of tissue damage, is an important factor in preventing the postoperative arthritis.

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