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Long-term results of arthroscopic capsulolabral revision repair for failed anterior shoulder instability repair using suture anchors at a minimum of 10 years follow-up

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Abstract

Introduction Arthroscopic revision anterior shoulder instability repair has been proposed, and early clinical results have been promising. However, long-term results after this procedure and the probable risk factors for failure have not been sufficiently discussed in the literature.

Materials and methods Thirty-eight patients who were diagnosed with recurrent anteroinferior shoulder instability after failed Bankart repair, treated with ACRR between September 1998 and November 2003 and able to be contacted were included. Of these patients, 2 were excluded from the study due to the use of SureTak anchors for fixation, and 5 other patients refused to participate in the study due to lack of interest (3 patients) or lack of time (2 patients). The remaining shoulders were clinically examined at a minimum of ten years after surgery via the ASES, Constant, AAOS, Rowe, Dawson and VAS scores for pain and stability. Degenerative arthropathy was assessed with the modified Samilson-Prieto score.

Results All 31 remaining shoulders were evaluated at a mean time of 11.86 years (142.4 months) after surgery. Six patients (19.35%) reported redislocation after the revision procedure, 4 of whom were affected by a new significant shoulder trauma. The ROWE and Constant scores improved significantly. Moderate to severe dislocation arthropathy was observed in 19.4% of patients. Five patients (16.2%) were not satisfied with the procedure.

Conclusion Long-term follow-up after ACRR shows predictable results, with a high degree of patient satisfaction, good to excellent patient-reported outcome scores and minimal radiological degenerative changes. However, with an average recurrence rate of 19.3% after 11.86 years, the redislocation rate appears high. With careful patient selection, recurrence rates can be significantly reduced.

Keywords Arthroscopic capsulolabral revision repair (ACRR) · Failed shoulder instability repair · Recurrent shoulder instability · Shoulder dislocation · Bankart repair · Shoulder instability

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Introduction

The classic lesion described after acute traumatic antero-inferior shoulder dislocation is the Bankart lesion, which involves disruption of the antero-inferior labrum and glenohumeral ligaments [1, 23].

The recurrence of instability is one of the most common and disabling problems, particularly in athletes [21].

Currently, arthroscopic capsulolabral repair is considered the standard treatment for shoulder instability since the results are comparable to those of open capsulolabral repair [10, 12, 13]. However, this approach is associated with high redislocation and revision rates, particularly if the quality of the capsulolabral tissues is inadequate or if glenohumeral bone loss is not precisely evaluated or excluded [17, 29].

For revision, bone block procedures such as the Latarjet procedure have gained popularity in recent years [7, 9, 23, 28]. Another less invasive technique for managing these pathologies is arthroscopic capsulolabral revision repair (ACRR), which has been proposed and has shown promising early clinical results in properly selected cases. However, to the best of our knowledge, there are no published studies on the long-term outcomes of ACRR.

Furthermore, few studies have focused on the factors that may be associated with or predispose patients to failure and may result in poor study outcomes [27].

The purpose of this study was to evaluate the clinical and radiological long-term outcomes following ACRR including return to sport, and to compare these to the short- and mid-term outcomes following ACRR described in the literature, as well as alternative procedures. Furthermore, risk factors for recurrence following ACRR were evaluated.

Materials and methods

The following inclusion criteria were applied in our study:

- 1) Patients who failed previous open or arthroscopic capsulolabral (Bankart) repair with persistent instability and who underwent arthroscopic capsulolabral revision repair (ACRR) using suture anchors during the period between July 1997 and November 2003.

- 2) Nonsignificant bony lesions of the glenoid (less than 20% of the glenoid width based on a 3D CT scan comparing both shoulders using the sagittal best fit circle technique in the glenoid enface view) and the humeral head (nonengaging Hill-Sachs lesions as documented in operative reports based on MRI and 3D CT scans).

- 3) Patients provided informed consent to participate in the study.

The exclusion criteria were as follows:

- 1) Patients who underwent nonanatomic procedures (e.g., coracoid transfer and glenoid reconstruction with bony block operations), those who were treated via open transosseous suturing techniques, those who received nonsuture anchors (i.e., SureTak anchors, Smith & Nephew, London, UK) or those with solely arthroscopic capsular shifts.

- 2) Patients with concomitant rotator cuff tears.

- 3) Patients with concomitant multidirectional or voluntary instability.

- 4) Patients with neurological disorders affecting the shoulder joint or preventing the rehabilitation program.

Data regarding the surgical technique (including the number, type and position of the fixation devices used), number of preoperative dislocations, dominant side, and time interval between the first dislocation and operation were collected from the patients' medical records. An experienced orthopedic surgeon performed a complete clinical shoulder examination focusing on the instability tests and range of motion. The results were noted as described by Hawkins et al. [11]

The following scores were used to assess the clinical results of the patients and designated primary outcome measures: the ASES (American Shoulder and Elbow Surgeons) score, Constant-Murley score, the Rowe Score, AAOS score (American Academy of Orthopaedic surgeons) and Dawson 12-item score. Muscle strength was measured with the Constant score using Isoex 3.0 (Primatron AG, Bern, Switzerland) [4, 6, 11, 16, 20, 24, 25].

The visual analog scale (VAS) score, which is used to assess pain intensity and stability, as well as patient satisfaction with the outcome were also obtained. Shoulder radiographs were assessed for degenerative changes and graded according to the Samilson-Prieto classification [26].

The study protocol was approved by the Institutional Review Board (IRB approval No. 5197/11).

A power analysis was not conducted due to the relatively small number of patients operated on with this technique.

Risk factors

Different risk factors that have been investigated in the literature for a potential association with failure of arthroscopic shoulder stabilization procedures were evaluated in our study.

The exclusion criteria included age at first dislocation, sex, dominance of the affected shoulder, total number of dislocation episodes prior to the last procedure, interval of instability before the first surgery, number of anchors used, number of previous stabilization procedures performed and presence of hyperlaxity. Data concerning the preoperative factors were retrieved from the hospital database system

and documented for all patients at the last preoperative visit to avoid recall bias.

Surgical technique and rehabilitation

The most senior author (A.B.I.) performed the surgical intervention on all patients. The arthroscopic repair technique and the postoperative rehabilitation protocol were standardized for all patients [2]. Examination under anesthesia was first performed to document the direction and degree of instability. The operation was performed while the participants were in the beach chair position. Only suture anchors were used for fixation of the capsulolabral lesions (BioFastak, Arthrex, Naples, Florida). The number of anchors used was individualized according to the extent of the lesion in the capsulolabral complex.

Statistical analysis

SPSS software version 20 (SPSS, Inc., Chicago, Illinois) was used for statistical analysis. The normality of the distribution of the data was assessed using the Kolmogorov–Smirnov test. Paired and unpaired *t* tests were used to analyze normally distributed data. The Wilcoxon and Mann–Whitney *U* tests were used to analyze nonnormally distributed data. Dichotomous data were analyzed by the chi-square test. The level of significance was set at a *P* value < 0.05.

Results

Thirty-eight patients underwent surgery in our department between September 1998 and November 2003. Thirty-one patients (shoulders) (representing 81.57%) fulfilled the inclusion criteria and could be contacted and evaluated after a minimum of 10 years after the procedure. Two patients were excluded from our study because they underwent surgery with nonsuture anchors (SureTak anchors, Smith & Nephew, London, UK), while another 5 patients refused to participate in the study due to lack of interest (3) or lack of time (2).

Of the 31 patients, one could only be evaluated through a postal questionnaire.

Table 1 Clinical outcome scores in all patients at 11.38 years (mean) after revision surgery

Score	Preoperative Median + Range	Postoperative Median + Range	Significance
ROWE	40 (20–92)	75 (15–100)	<i>P</i> = 0.045
Constant	71 (36–91)	89 (35–100)	<i>P</i> = 0.036
ASES	Not measured	90 (58–100)	-
Dawson	Not measured	16 (12–42)	-
AAOS	Not measured	94 (72–100)	-

The mean follow-up interval was 11.86 years (142.39 months) after the last arthroscopic capsulolabral revision repair was performed at our center. Five patients underwent surgery more than one time before the revision procedure; four underwent arthroscopy twice, one underwent surgery three times, 2 underwent arthroscopy, and one underwent open Bankart repair. Twenty-six patients (83.8%) were satisfied with the operation and would repeat it, five patients (16.7%) were not satisfied with the results of the operation; they said they would not undergo the operation again because of either the persistence of symptoms or higher expectations.

The mean VAS score for instability was 2.65/10 (SD = 2.74). The mean VAS score for pain on the operated side was 1.26/10 (SD = 2.12), and that on the contralateral nonoperated side was 0.39/10 (SD = 1.2).

Redislocation and recurrence of instability after revision surgery

Six patients experienced redislocation after our revision procedure (19.35%) at some point during the postoperative follow-up. Four patients reported significant trauma causing redislocation, and the other two patients did not report any significant trauma. Five of these patients had previously undergone arthroscopic repair and one patient had undergone an open stabilization procedure. Three of those six patients reported a single episode of dislocation after the revision procedure.

The median duration between the primary stabilization surgery and our arthroscopic revision procedure was 48 months (range 5–112 months). The median duration of instability between the time of recurrence due to instability after the initial stabilization procedure and after our revision arthroscopic procedure was 9 months (range 1–61 months).

New trauma as a cause of failure and revision

Twenty-seven patients (87.1%) reported new trauma as the main cause of redislocation after the preceding stabilization procedure, thus requiring our revision. This may have occurred either during participation in a sport, during a fall on the operated shoulder or due to forced abduction/external rotation during normal daily activities. Four (12.9%) patients did not report a traumatic incident as a cause of persistent instability or dislocation.

Clinical scores

The overall clinical scores at the mean follow-up period of 11.38 years are summarized in Table 1. The Rowe and Constant scores showed significant postoperative improvement.

Sport activity

Eight of the 31 patients (25.8%) included in this study reported a reduced level of sport activity after the revision procedure compared to their level predislocation. All patients reported a reduced level of time spent participating in an amateur sport to hobby or leisure-time sport. All the other 23 patients reported a return to the same level of sport activity (74.2%).

Analysis of the results and risk factors for redislocation and recurrence of instability.

Age

The median patient age at the time of revision surgery was 26.6 years (range 17–52 years). There was no significant difference in the age of the patients or the long-term incidence of dislocation after the revision procedure ($P=0.827$). The mean age of patients with postoperative dislocation was 29.95 years, while the mean age of those who did not experience any dislocation or instability was 28.59 years.

Sex and dominant side

There were 25 males (80.64%) and 6 females (19.36%). The dominant shoulder was affected in 27 patients (87.1%). Three of 25 males included in the current study experienced recurrent dislocation after ACRR (12%), whereas three of 6 females who underwent surgery with this technique experienced recurrent instability and failure of the procedure (50%). Although the percentage of re instability in females was obviously higher than that in males, this difference was not statistically significant.

All six failed procedures in our series involved the dominant shoulder (27 dominant-side shoulders), whereas no failures occurred on the operated, nondominant side (4 nondominant shoulders). However, this difference was not statistically significant ($P=0.294$).

Number of previous surgeries

Twenty-four patients underwent surgery once before our procedure. Four patients experienced recurrent dislocation (16.66%). Six patients underwent surgery twice, 2 of whom experienced a failed procedure (33.33%), and one patient underwent surgery 3 times and did not experience any signs of instability after our procedure. Although the incidence of dislocation in patients who underwent surgery more than one time before ACRR may be approximately twice that after a single failed procedure, this difference was not statistically significant ($P=0.483$).

Hyperlaxity

Data on capsular quality were retrieved for 25 patients. Six of these patients had multidirectional hyperlaxity on clinical examination, and five (20%) exhibited poor-quality capsular tissue on arthroscopic examination.

No association was found between capsular hyperlaxity and recurrent instability after our revision procedure ($P=0.383$).

Number of anchors used

The mean number of anchors used for the revision procedure was 3.55 (SD=0.77 and range=2–5). Two anchors were used in 2 patients, three anchors were used in 13 patients (4 patients experienced redislocation), four anchors were used in 13 patients (2 patients experienced redislocation), and five anchors were used in three patients. The number of anchors used was not significantly associated with the recurrence of instability ($P=0.246$).

Number of preoperative dislocations

The patients were categorized into one of three groups: Group A included patients who experienced one dislocation or subluxation; this group included 2 patients, and none of them reported a recurrence of instability after the revision procedure. Group B included patients who experienced 2–5 preoperative dislocations; in this group, 7 patients were included, and 2 of them reported recurrent dislocation after the revision procedure (28.5%). Group C included patients who experienced more than 5 dislocations. This group included 22 patients, 4 of whom reported recurrent dislocation after the ACRR procedure (18.18%). No significant association was found between a greater number of preoperative dislocations and failure of the revision procedure ($P=0.903$).

Prevalence and risk factors for dislocation arthropathy

Radiographs of the 31 patients at a minimum of ten years after the procedure were obtained and evaluated using the Samilson-Prieto classification. Twenty-five patients (80.6%) did not show any or had minimal radiological changes (Samilson I) suggestive of mild glenohumeral arthropathy. Moderate (Samilson II) to severe arthropathy (Samilson III) (19.4%) was observed in six patients. There was no significant association between the incidence of arthropathy and patient age ($P=0.086$), number of dislocations ($P=0.066$), time interval from the first dislocation to the first operation ($P=0.137$), number of previous surgeries

($P=0.225$), number of anchors used in the revision procedure ($P=0.682$) or duration of recurrent instability before the revision procedure ($P=0.487$).

Discussion

In the current study, we found adequate clinical and radiological long-term outcomes in 31 shoulders following ACRR performed with suture anchors at a mean of 11.86 years. We found good clinical outcomes, high patient satisfaction and good ability to return to sports in our study. Additionally, minimal radiological degenerative changes and satisfactory stability were reported. A comparably high rate of re instability following ACRR in the literature at short- to mid-term follow-up durations (between 10% and 42%) has been reported [2, 15, 27].

However, to the best of our knowledge, no long-term outcomes have been published to date.

In their early series of 56 patients treated with ACRR, Bartl et al. reported a recurrence rate of 11% at an average of 37 months of follow-up [2]. The previous stabilization procedures that were revised via ACRR in their study ranged from arthroscopic procedures with suture anchors, tacks or transglenoid sutures to open procedures using anchors, transosseous sutures or solely capsular shifts. Given the mid-term follow-up duration of 37 months, their results are similar to those published in the literature on initial arthroscopic stabilization results.

Kim et al. performed a prospective study of 23 patients treated with revision suture anchor repair for failed Bankart repair at a mean of 3 years and reported a success rate of 78% [14]. In their study, the maximum glenoid bone loss allowed for inclusion was 30%. Recurrent instability was associated with contact sports. Although these patients had higher rates of re instability than did those in our study, this may be due to the inclusion of patients with higher degrees of glenoid bone loss.

Creighton et al. reported a 28% clinical failure rate in their study that included 18 patients who were followed for a mean of 29.7 months following arthroscopic labral fixation and plication after failed traumatic instability repairs [5]. They performed posterior capsular plication in addition to anterior capsulolabral repair and closure of the rotator interval. However, persisting pain was also rated as a clinical failure in this study. The rate of frank redislocation was 17%. Although they had comparable rates of re instability, the higher rate of clinical failure and persistent pain renders the technique inconclusive. This failure may be due to plication of the posterior capsule and closure of the rotator interval, which are fundamental differences, especially given the

relatively small number of patients and the short duration of follow-up.

Neri et al. followed 11 patients for a mean of 34.4 months and reported a recurrent instability rate of 27% in patients following ACRR and closure of the rotator interval [18]. The short follow-up duration and the small number of patients, however, did not allow any analysis regarding the cause of failure or selection criteria for the procedure.

Patel et al. treated 40 patients with capsulolabral repair via suture anchors and followed them for 36 months [22]. Only 4 patients, representing approximately 11% of the study group, experienced failure or persistent instability, comparable to that of other studies with a short-term follow-up. The authors reported a return-to-sports rate of 80%.

In a recent systematic review on clinical outcomes following ACRR pooling of the results of 339 shoulders in 14 studies, Yon et al. published a mean rate of recurrent instability of 15.3% after revision arthroscopic Bankart repair [30]. The authors concluded that ACRR may lead to improved functional outcomes and patient satisfaction with proper patient selection. However, the pooled data were based on patients with a mean FU duration of 36.7 months, which represents a large difference compared to our study.

Overall, the reported short- to midterm recurrence rates in the literature are comparable to our long-term recurrence rate.

Su et al. focused on risk factors for failure in 65 patients who underwent arthroscopic stabilization after failed Bankart repair [27]. The mean age of the patients was 26 years (15 to 57 years), and the mean follow-up duration was 4.7 years (2 to 10.8 years). 42% of the patients reported recurrent instability after the revision operation. On multivariate analysis, age less than 22 years, the presence of off-track Hill-Sachs lesions and ligamentous laxity were found to be independent predictors of recurrence.

In contrast, in our long-term outcome analysis, neither age nor ligamentous laxity was associated with a higher recurrence rate.

Although females experience a higher rate of re instability than males, this difference could not be confirmed to be statistically significant, which may be due to the small number of females included in the current study (only 6 patients) or to the small number of patients overall, which may render it underpowered to answer such a question. The number of patients included needs special consideration in future studies to assess whether this difference is statistically significant.

The recurrence rate was higher in patients who underwent multiple previous surgeries and patients who had a higher incidence of preoperative dislocation. Significant bone loss was not evaluated, as patients with bone defects were excluded from our study.

Overall, even though the long-term recurrence rates in our study are comparable to the short- and mid-term recurrence rates in the literature and despite the good clinical and radiological outcomes, the failure rate following stabilization surgery remains high (19.3%). In particular, in the present study, only frank shoulder dislocations were regarded as recurrently unstable rather than subjectively unstable on apprehension tests.

In recent years, bone block procedures (i.e., the Latarjet procedure) have gained increased popularity for the treatment/ revision of failed Bankart procedures, especially in patients with bone loss [7, 9, 28, 30]. Flinkkilä et al. reported a 14% recurrence rate following the open Latarjet procedure for failed arthroscopic Bankart repairs in a consecutive series of 49 patients [8]. Most cases were regarded as failures; however, only subluxations were reported, and only 1 of 49 patients experienced a frank dislocation.

These favorable results associated with the Latarjet procedure in a revision situation are supported by a recently published comparative study in which a revision Bankart procedure was compared to a revision Latarjet procedure for failed arthroscopic Bankart repair [7]. The authors found no dislocations in the Latarjet revision group, while 43% of patients experienced recurrent dislocation following ACRR in that study.

In contrast, in another recently published comparative study, O'Neill et al. reported comparable results for both procedures [19]. Eight of 21 patients in the ACRR group and 7 of 24 patients in the Latarjet group reported instability symptoms postoperatively, while 3 and 2 patients, respectively, experienced full dislocation postoperatively.

These findings are comparable to the findings from our long-term study population.

Based on our study and the literature, we believe that arthroscopic revision Bankart surgery using suture anchors can provide good outcomes with a good degree of patient satisfaction and an acceptable recurrence rate in carefully selected patients.

Regarding return to sport, Buckup et al. recently published their retrospective case series on return to sport following ACRR [3]. At 28.7 months, 70% of their 20 athletes were able to return to their original sporting activity. However, 90% of patients reported a limitation in their shoulder when performing their sport. Overall, their results are comparable to ours, with a 74.2% return-to-sports rate.

This study has several limitations. First, the retrospective nature of the data acquired in our study may carry the risk of recall bias, and only preoperative clinical ROWE and Constant scores were saved in our archival data. Second, the heterogeneity of the patients and study designs hamper direct comparisons between studies. This is especially the case regarding the definition of failure. In the present

study, only complete dislocations were defined as failures, while other authors regarded the patient's subjective notion of instability as failure. Our definition of failure will rather underestimate clinical failure rates. Third, the number of patients in our study was limited, and the risk factor analysis was likely underpowered. The third limitation is the small number of females compared to males and the small total number of patients in total.

However, we present data from 31 shoulders collected nearly 12 years after ACRR. To our knowledge, this series reports the longest follow-up to date on this subject.

Conclusion

The long-term outcomes after ACRR were satisfactory, with a high degree of patient satisfaction, good patient-reported outcome scores, a high return to sport rate and minimal radiological degenerative changes. However, with an average recurrence rate of 19.3% after 11.86 years, the redislocation rate appears high.

With careful patient selection, recurrence rates can be reduced, and an acceptable recurrence rate can be achieved with ACRR using suture anchors.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s00402-024-05304-7>.

Author contributions first and second authors have equal contribution to designing the study, collecting patients, conducting examination and Data Analysis, writing the manuscript. 3rd authors: participated in examination of patients and collecting Literature. 4th Authors: Participated in designing the study and planning the methods. Revision of the results and manuscript. 5th Author: final revision of the manuscript. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Data availability Authors confirm the availability of the data and materials used in this study for any future request.

Declarations

Ethics approval and consent to participate This study was performed in line with the principles of the Declaration of Helsinki. The study had been approved by the Ethics Committee and Institutional Research Board in Technical University of Munich.

Consent for publication The authors affirm that human research participants provided informed consent for publication of the images and data in the manuscript.

Informed consent Informed consent was obtained from all individual participants included in the study.

Competing interests No conflict of Interest except the Last Author, Andreas B. Imhoff: Arthrex Inc. Naples: Royalties. ArthroSurface, Boston: Consultant and Royalties. Medi Bayreuth Germany: Consultant. On behalf of all authors, the corresponding author states that there is no conflict of interest and non-financial interests to disclose.

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