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SHOULDER

Long-term results of arthroscopic Bankart repair: Minimum 10 years of follow-up

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Abstract
Purpose This study investigated the long-term results of arthroscopic Bankart repair in terms of rates and timelines of recurrence of instability, with special interest in young adult patients aged ≤20 years.
Methods Between 2000 and 2005, 186 shoulders [182 patients, 50 women, median age 26 (range 15–58) years] were operated on at a university hospital using arthroscopic Bankart repair because of instability after traumatic antero-inferior shoulder dislocation. Medical records were retrospectively reviewed and patients were assessed using postal questionnaires or telephone interview after a minimum of 10 years of follow-up [median 12.2 (range 10–16) years]. The primary outcome measure was recurrence of instability (assessed from 167 shoulders), other outcome measures included Oxford instability score (OIS), subjective shoulder value (SSV), and Western Ontario instability index (WOSI) (assessed from 157 shoulders).
Results At the end of follow-up, 50/167 shoulders (30%) had recurrence of instability and 30/167 (18%) were subjected to reoperation due to instability symptoms. Twenty-six (52%) failures occurred within ≤2 years, 11 (22%) within 2–5 years, and 13 (26%) >5 years after surgery. Failure rate was 19/35 (54%) for patients aged ≤20 years and 31/132 (24%) for patients aged >20 years; reoperation rates were 11/35 (31%) and 19/132 (14%), respectively. Mean OIS was 20 (SD 9, range 12–50), SSV 83% (SD 21, range 10–100), and WOSI score 80 (SD 22, range 33–100).
Conclusions Nearly one-third of patients had recurrence of instability after arthroscopic Bankart repair after a minimum of 10-year follow-up. Patients aged ≤20 years did poorly with more than half of the patients having recurrence; alternative stabilization techniques should probably be considered for these patients.
Level of evidence IV.

Keywords Shoulder dislocation · Shoulder instability · Surgery · Bankart operation · Long-term outcome · Survival analysis

Introduction

A rapid evolution of practice from open stabilization to arthroscopic Bankart repair has taken place in the treatment of posttraumatic shoulder instability [1]. In Britain, arthroscopic shoulder stabilization surgery has more than quadrupled (from 16 to 71%) between the years 2002 and 2009 [1]. Using modern instruments and implants, arthroscopic Bankart repair is technically feasible in nearly all cases of instability. A recent systematic review of level IV studies with a minimum of 5 years of follow-up confirmed that open and arthroscopic Bankart repairs result in similar outcomes [2].

Previous studies have suggested that recurrences after arthroscopic Bankart repair occur mostly within 2 years after surgery [3]. However, some studies have reported contrasting results showing that failures do not all occur after 2 years, but rather continue to occur steadily during long-term follow-up [4, 5]. Only a few studies of arthroscopic Bankart repair have reported long-term failure rates. Failure rates in these studies ranged from 21 to 38% after

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a minimum of 10-year follow-up [6–8]. These long-term studies have not addressed the timeline of failure in detail.

Adolescents or young adults are at an especially high risk for failure after arthroscopic Bankart repair [9–12]. Previous studies have reported only short- to mid-term results in young patients, and little is known of the long-term failure or reoperation rates. Virtually all studies focusing on adolescent patients have included a mixed patient population, with skeletally mature and pediatric patients with open physes [13–16]. Therefore, the results may not be applicable to skeletally mature young adults who are the most common patient group undergoing shoulder stabilization surgery.

This study aimed to investigate the long-term results of arthroscopic Bankart repair in terms of the rate and timeline of recurrence of instability, with special interest in young adult patients who are aged ≤20 years.

Materials and methods

The study protocol and re-review of the patient records were approved by the hospital administration (Oulu University Hospital, number 138/2015). The patients comprised a previous cohort of 182 consecutive patients (132 men and 50 women) and included 186 shoulders with instability (recurrent dislocation or subluxation) after initial traumatic anteroinferior shoulder dislocation (Table 1). The patients were operated on using arthroscopic Bankart repair between the years 2000 and 2005 at a university hospital. The median age of the patients at the time of surgery was 26 (range 15–58) years and all patients were skeletally mature. No pediatric patients with open physes were included in the study. No open surgery was performed as the primary operation for shoulder instability during the study period at our institute. Plain radiographs were used to assess the presence of glenoid defects and Hill–Sachs lesion without trying to measure the size bone defects (Table 1). Patients with large (>25% of width in axial view) glenoid fractures and or cases with displaced greater tubercle fractures were excluded.

The Bankart lesion was repaired using standard arthroscopic techniques with suture anchors where the patient was positioned in a beach chair position. The details of the operative technique, postoperative care, and the short- to mid-term (median follow-up, 4.3 years) results have been published previously [11].

The recurrence of instability (dislocation, subluxation) verified by radiographs or typical history (feeling of apprehension, subluxation or dislocation) was defined as a treatment failure, and was the primary outcome measure of the study. Electronic medical records and radiographs were re-reviewed during 2015 to assess possible further visits due to shoulder problems, failures, and possible reoperations. The reason for a new referral, new injuries, the time (month and year) of recurrence, and the type and date of reoperations were recorded. Functional results were assessed by means of the Oxford score, subjective shoulder value (SSV), and Western Ontario shoulder instability (WOSI) score (0–100%) [17–19]. Questionnaires including these outcome measures, in addition to inquiries about new injuries, recurrence of dislocation, subluxations or instability symptoms and possible new operations, were delivered to the patients by postal mail. Those patients who

Table 1 Baseline variables of the patients

Variable	*N*
Sex	
Male (shoulders)	132 (135)
Female (shoulders)	50 (51)
Side	
Right	119
Left	67
Age at the time of surgery	
≤20 years	42
>20 years	144
Mechanism of injury	
Sports	89
Fall from standing height	35
Distension	15
Motor vehicle collision	11
Bicycle accident	8
Seizure	7
Fall from a height	6
Other injury	10
Unknown	5
Hill–Sachs lesion[a]	
No	70
Yes	113
Glenoid lesion[a]	
No	125
Erosion	25
Fracture	33
Number of anchors	
2	12
3	96
4	72
5	6
Associated lesions (arthroscopy)	
No	141
Osteoarthritis	15
SLAP or posterior labral lesion	26
Rotator cuff lesion	4

[a]Missing radiographs in three cases

did not respond were contacted by telephone and the same forms were completed during an interview. In case patients had moved outside our hospital's catchment area and had undergone new operations, the patients were contacted for the details of the failure and surgery. The interviewer was not involved in patient care.

The results of the Oxford score and SSV were compared with those of the earlier study [11]. The timeline of failure was assessed after combining data from both the medical records and the questionnaires. The functional scores were compared between patients who had only the index operation and those who had reoperations.

Statistical methods

Summary data are presented as the mean, standard deviation (SD), and range unless otherwise stated. Kaplan–Meier survival analysis was performed to assess time to failure and time to reoperation. Log-rank test was used to compare survival times. Independent samples *t* test was used for comparison of means, and paired samples *t* test was used for repeated measurements for continuous variables. A value of $P < 0.05$ was considered significant. All analyses were performed using SPSS for Windows (IBM Corp, Released 2013, IBM Statistics for Windows, Version 22.0, Armonk, NY).

Results

A total of 153 patients (157 shoulders) completed the questionnaires. Three patients had died, seven patients were not interested in participating in the study, and 19 patients were lost to follow-up. They did not respond to repeated letters, and their telephone numbers were unknown. The data from the medical records of 10 of these 29 patients allowed assessment of shoulder stability or reoperations, and these data were combined with the questionnaires. Thus, the stability could be assessed from 167 (90%) shoulders and functional scores from 157 (84%) shoulders after a median follow-up of 122 (10–16) years.

At the end of follow-up, 50 of 167 shoulders had recurrence of instability (30%) and 30/167 (18%) were reoperated on due to instability symptoms. Twenty-six (52%) failures occurred within ≤2 years, 11 (22%) between 2 and 5 years, and 13 (26%) >5 years after surgery (Fig. 1). Mean time from the operation to failure was 3.4 (SD 3.5, range 0.1–14.0) years, mean time to reoperation from primary operation was 3.8 (SD 3.2, range 0.7–12.4) years. Mean interval from failure to reoperation was on average 1.1 (SD 1.1, range 0.1–7.5) years. The failure rate was 19/35 (54%) for patients aged ≤20 years (Fig. 2) and 31/132 (24%) for patients aged>20 years (Fig. 3); reoperation rates were 11/35 (31%) and 19/132 (14%), respectively.

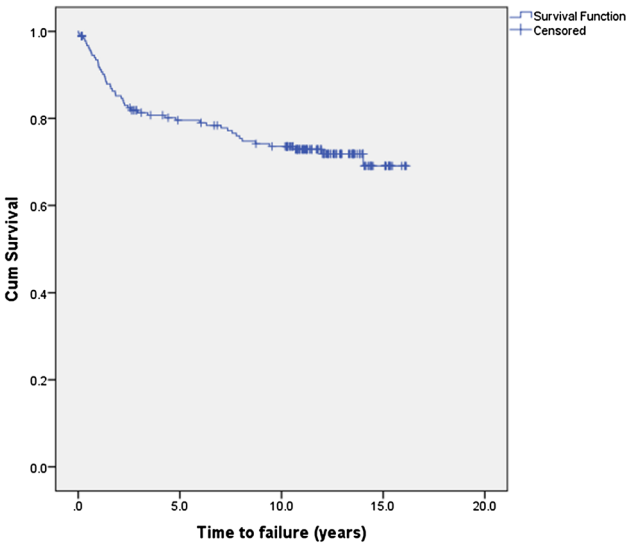

Fig. 1 Kaplan–Meier survival analysis of the time to recurrence of instability. The estimate for the cumulative proportion of stable shoulders after a mean follow-up of 12.5 years was 0.72

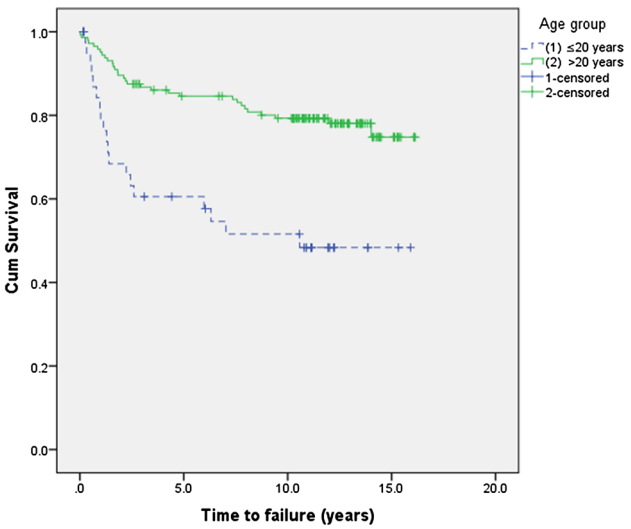

Fig. 2 Kaplan–Meier survival analysis of time to recurrence of instability in patients aged ≤20 years and >20 years. The estimates for the cumulative proportion of stable shoulders at a mean follow-up of 12.5 years were and 0.48 for patients aged ≤20 years and 0.78 for patients aged >20 years. Log-rank test, $P < 0.001$

Reoperations included arthroscopic revision Bankart in 18 cases, open Latarjet procedure in 10 cases, open Bankart in one patient, and debridement in one patient. Arthroscopic or open revision Bankart failed in 8/19 (42%) cases and re-revision surgery was needed (Fig. 4). Thirty-eight patients regarded a new injury as the reason

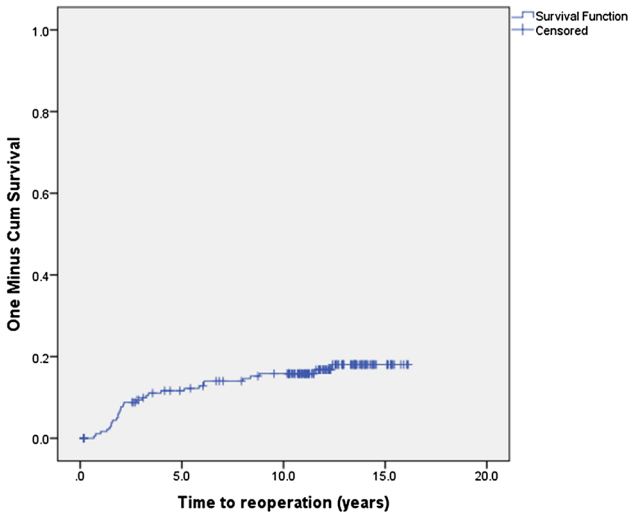

Fig. 3 Kaplan–Meier estimate of the time to reoperation after arthroscopic Bankart repair. The estimate of the cumulative proportion of shoulders with revision surgery after a mean follow-up of 12.5 years was 0.18

for the failure, but 12 patients did not recall any new injury before recurrence of symptoms.

Functional scores did not change between 5 and 12 years [mean Oxford score at 5 years was 21 (SD 10, range 12–54) vs. 20 (SD 9, range 12–50), n.s at 12 years; SSV was 84% (SD 17, range 10–100) vs. 83% (SD 21, range 10–100), n.s, respectively, paired samples *t* test; mean WOSI score was 80 (SD 22, range 33–100) at 12 years].

Patients who underwent only the index operation had substantially better functional scores at the end of follow-up compared to those who needed reoperations (Oxford score 19 vs. 24, $P = 0.03$; SSV 85 vs. 73, $P = 0.005$; WOSI 83 vs. 67, $P = 0.001$, independent samples *t* tests).

Discussion

This study showed that in terms of recurrence of instability, the results of arthroscopic Bankart repair in unselected patient material deteriorate during long-term follow-up. The probability of a stable shoulder after a mean follow-up of 12.5 years was 72% and nearly half of the recurrences occurred 2 years after surgery. Patients aged ≤20 years did especially poorly, with only an estimated 48% having a stable shoulder. The functional scores did not change between 5 and 12 years, but patients who needed reoperations had substantially lower scores compared to others. The results of arthroscopic revision Bankart repair were unpredictable. Open Latarjet procedure was the most reliable revision surgery.

A recent systematic review of open and arthroscopic Bankart repair, with a minimum of 5-year follow-up, concluded that the recurrence rate of instability was 11 and 8% for arthroscopic and open surgeries, respectively [2]. As shown by our study and those of Privitera et al., Castagna et al., and Plath et al. with a minimum 10 years of follow-up, the true recurrence rate is much higher, ranging from 21 to 35% [6–8]. The reported long-term failure rates of arthroscopic Bankart repair are substantially higher than those from open Bankart and Latarjet procedures, with a minimum of 10-year follow-up. The recurrence rates ranged from 7 to 18% and from 1 to 13%, respectively [20–26].

An interesting finding was that half of the recurrences occurred after 2 years of follow-up, and about one-fourth

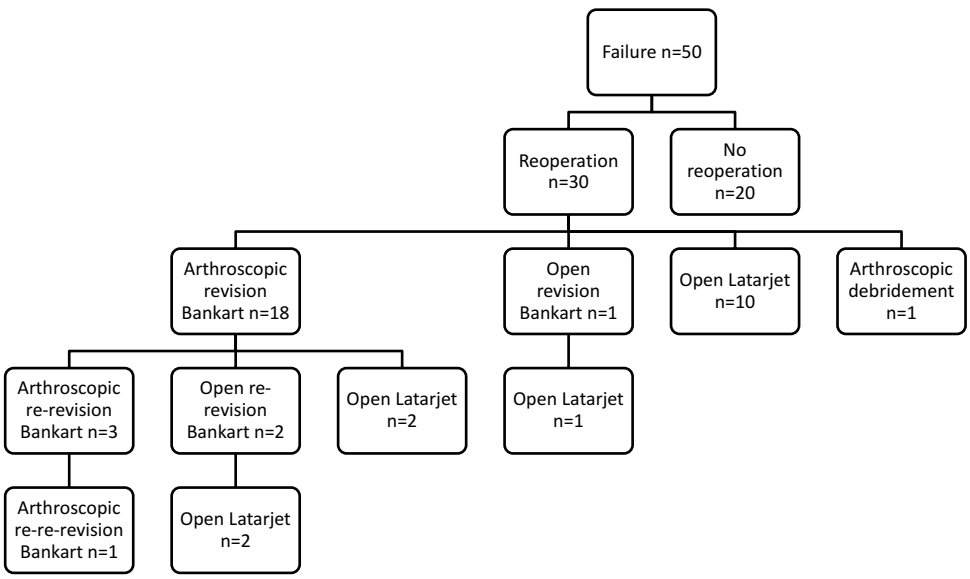

Fig. 4 Reoperations after failure

after 5 years of follow-up. Bessiere et al. and van der Linde et al. reported a similar trend in their studies after 6 and 8 years of follow-up, respectively [4, 5]. Most studies report results after only 2 years of follow-up. Clearly, a longer, minimum of 5-year follow-up is needed to assess the actual effectiveness of arthroscopic Bankart repair.

Many studies have identified young age as an independent risk factor for failure after arthroscopic Bankart repair [9–12]. Previous studies focusing on young patients have also included pediatric patients, and the results of those studies may not be directly comparable to ours. Shymon et al. reported a 49% 5-year survival rate of both open and arthroscopic Bankart repairs in an adolescent population, with a mean age of 17 years [16]. Nixon et al. reported a 31% failure rate in a cohort of patients with a mean age of 17 years, but their mean follow-up was only 22 months [15]. Castagna et al. found a 21% failure rate in patients aged <18 years, with a mean follow-up of 5 years [13]. The patients participated in overhead or contact sports, making it a population at risk. Khan et al. reported on skeletally immature patients (aged <16 years), with a 7% recurrence of dislocation after open Latarjet operation, with a mean follow-up of 10 years [27].

The patient cohort in this study consisted of consecutive patients with several dislocations. They probably had bony erosions of the glenoid and engaging or bipolar off-track Hill–Sachs lesions, which nowadays are considered by many as contraindications for arthroscopic Bankart repair [28]. This could partly explain the high recurrence rate, and patient selection could probably improve the results [25, 29]. Also, early surgery after primary dislocation could lower the recurrence rate. Long-term results after primary stabilization were substantially better than our results. Owens et al. reported a 36% recurrence rate after a minimum of 9-year follow-up in young (17–23 years) adult patients [30]. Kirkley et al. found a 25% recurrence rate after a minimum of 6.5 years of follow-up in patients aged <30 years undergoing primary stabilization [3]. Less severe pathology after the primary dislocation compared to recurrent dislocation could better explain these stabilization results after primary dislocation. Also newer techniques, including remplissage, could possibly improve results, but no long-term studies have been published so far.

Several techniques have been used for revision stabilization after failed Bankart repair [31]. Our experience is similar to that of Blackman et al. who concluded that arthroscopic and open revision Bankart repair is unpredictable, especially in adolescents, with failure rates of about 33% after mid-term (5-year) follow-up [32]. Latarjet procedure may be the best choice for revision surgery, with about a 14% failure rate regardless of bony pathology [33, 34].

The strengths of the study include a large number of patients, with a very high follow-up rate for a long-term study. The technique was similar in all patients. The criteria for failure were subjective because the goal of stabilization surgery is to eliminate instability symptoms, as pointed out by van der Linde et al. [35]. Therefore, subjective feeling of instability is probably the best measure of failure.

This study has also certain weaknesses. The design of the study was retrospective, and sports- and non-sports related recurrences could not be separated. The long period between assessments may have caused recall bias. However, we combined the information from our previous report with medical records and therefore believe that we could reliably determine the timeline of failure. The primary outcome was based on radiologically verified redislocation or typical history alone, and we did not perform clinical examinations to assess apprehension and no follow-up radiographs were available. Additionally, functional scores were not available for all patients.

In the future, randomized clinical trials (RCT) should be done focused on comparing different stabilization techniques, especially in young patients. According to clinicaltrials.gov (http://www.clinicaltrials.gov), such an investigation comparing arthroscopic Bankart repair with open Latarjet procedure in young male patients is currently recruiting patients. Two years of follow-up, which is commonly used in RCTs, is clearly too short a period to determine the true effectiveness of these interventions, and a minimum of 5 years of follow-up is needed, which poses a challenge for RCTs.

Conclusions

In this study, nearly one-third of patients had recurrences of instability after arthroscopic Bankart repair after a minimum of 10-year follow-up. Patients aged ≤20 years did especially poorly with more than half of the patients having recurrence, and alternative stabilization techniques should probably be considered for these patients.

Author contributions TF analyzed the data and drafted the manuscript. RK reviewed the patient records, posted the questionnaires and interviewed the patients, KS critically revised the manuscript, PO helped in statistics, JL critically revised the manuscript. All authors read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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Ethical approval No ethical approval was required by the Hospital administration.

Informed consent Informed consent was not applicable to this study.

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