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Factors affecting recurrence following arthroscopic Bankart repair in recreational athletes

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Abstract

Detailed evaluation for recurrence following arthroscopic Bankart repair (ABR)s is important to develop strategies to decrease recurrence rates. The aim of this study was to evaluate the outcomes following ABR and to investigate clinical, functional and demographic data by recurrence status in recreational athletes. A total of 67 consecutive ABRs (63 males, 4 females) with a minimum 5-year follow-up were included in the study. Pre- and post-operative clinical and functional outcomes were evaluated using VAS, shoulder ROM, ASES, UCLA, Constant-Murley, Oxford Instability and Rowe scores. Patient characteristics were evaluated to investigate the correlation with the outcomes. Factors associated with recurrence were also evaluated. The mean age was 30.8 ± 7.7 years and the mean follow-up was 87.7 ± 19.1 months. Good to excellent postoperative functional and clinical outcomes were obtained in the last follow-up compared with the baseline (p<0.001). Eleven shoulders (16.5%) experienced recurrent instability. Contact sports, glenoid bone loss, Hill-Sachs lesions and smoking habit were associated with recurrence status (p=0.007, p=0.043, p=0.023, p=0.017, respectively). Only postoperative abduction degree was significantly higher in recurrence (-) patients compared to recurrence (+) patients (p<0.001). No major complications were occurred in peri- or post-operative period. Forty-seven patients returned to their preoperative sports activity levels. Good to excellent medium- to long-term functional and clinical outcomes were achieved after ABR. Contact sports, glenoid bone loss, Hill-Sachs lesions and smoking habit were associated with recurrence after ABRs.

Keywords: Shoulder, instability, Bankart, recurrence, return to sports, Hill-sachs lesion, athlete

Introduction

Traumatic recurrent anterior shoulder instability is a pathology that commonly seen in young and active patients [1]. Standard treatment is to repair the capsulolabral disruption for this condition. Open Bankart repair is still used in the management of glenohumeral dislocation. However, numerous arthroscopic surgical techniques have been developed over the past 2 decades, and arthroscopic techniques have predominated with low operative complication rates [2-5].

The main aim of arthroscopic Bankart repairs (ABR) is to avoid recurrent instability after surgery. Although ABR has been shown to result in excellent long-term functional and clinical outcomes, a high rate of recurrent instability (up to 40%) has been reported in the literature [6-8]. Various factors such as younger age (<19 years), Caucasian race, sports activity, closed reduction before the first repair, bilateral instability, hand dominance, significant bone loss in glenoid and humerus, off-track Hill-Sachs lesion and male gender were found to be associated with higher recurrence after ABRs [8-12]. Detailed evaluation of recurrence cases after ABRs is important to develop strategies to decrease recurrence rates.

Several studies in the literature have evaluated the factors affecting failure and recurrence rate after ABRs [6,8,9,12-18]. However, there has been no detailed study thoroughly investigating the effects of these factors on recurrence in recreational athletes. This study aimed to evaluate the functional and clinical outcomes of patients who were operated for anterior shoulder instability and to comprehensively compare the outcomes, patient characteristics and surgical factors by recurrence status in the mid-term. Our hypothesis was that patient characteristics, preoperative clinical and surgical factors affect recurrence status.

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Materials and Methods

Patients

Between 2008 and 2014, an experienced single surgeon (with at least 5 years of performing arthroscopic shoulder surgery) performed ABRs on 136 shoulders. Of these, we retrospectively evaluated 67 ABRs with a minimum follow-up of 5-year. The inclusion criteria were: was a recreational athlete; had primary arthroscopic Bankart repair, traumatic anterior instability with/without superior labrum anterior and posterior (SLAP) lesion [19], willingness to participate in the study, compliant with the postoperative rehabilitation protocol, and had a minimum 5 years follow-up. The exclusion criteria were: patients had multi-directional instability without clear trauma episode (5 patients), existence of preoperative arthropathy [20] (2 patients), preoperative rotator cuff tear (5 patients), history of ipsilateral upper extremity surgery (3 patients) and/or rheumatologic disorder (2 patients), neurological problems including cervical myelopathy or any neuropathic disorder affecting ipsilateral or contralateral extremity (5 patients), posterior instability repair (5 patients), any previous surgery for the affected extremity (10 patients), bone loss of anterior glenoid > 17 % [21] (13 patients) and lost in follow-ups (19 patients) (Figure 1).

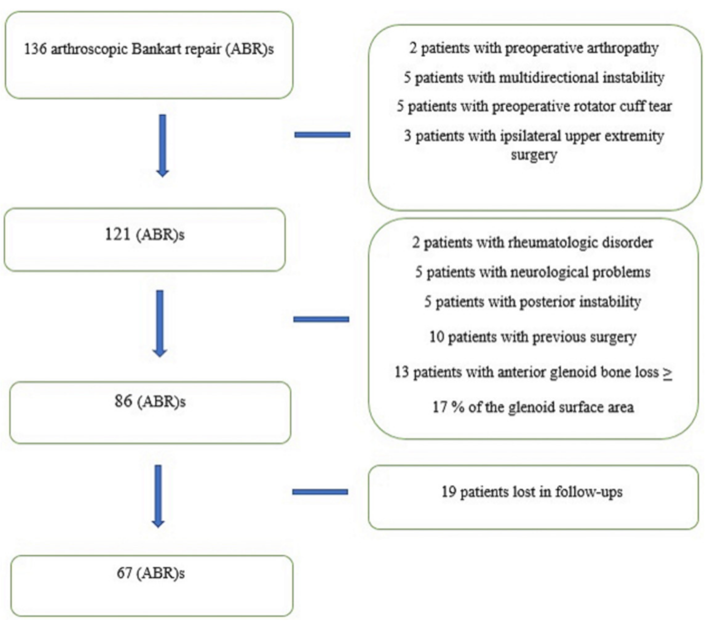

Figure 1. Study flowchart and patient exclusion details

Surgical method

All surgeries were performed arthroscopically by the same surgeon in beach chair position. First, a standard posterior portal was established to diagnose the intraarticular pathologies. A second standard anterior working portal was established through the rotator interval in all consecutive cases, and an anterosuperolateral portal was also made for visualization of the anterior glenoid. After observing that the anteroinferior capsulolabral complex was completely separated from the glenoid, repair was performed using the anterior portal. The suture anchors (Twinfix, Ultrabraid, Smith and Nephew, London, UK) were double-loaded and placed using the anterior glenohumeral portal. The first anchor was inserted inferiorly to 5.30 position, and the other anchors were placed upward to the Bankart lesion's superior extention. A shuttle was used to pass the suture through the anterior capsulolabral complex then tied to fix the capsulolabral complex at anterior of the glenoid. Depending on the amount of labrum detachment from the glenoid rim and concomitant SLAP lesion, two or more anchors were used to complete the capsulolabral complex repair. The SLAP lesion was also repaired using suture anchors in cases diagnosed according to arthroscopic examination and clinical examination. Ten patients had concomitant SLAP lesions. Two patients with type 1 SLAP lesions were treated with debridement while 8 patients with type 5 SLAP lesion underwent slap repair in addition to Bankart repair.

Postoperative rehabilitation

Appropriate doses of analgesics (tenoxicam) were administrated to all patients in the first 24 hours [22]. All patients used a shoulder immobilizer in 30 degree abduction and neutral positions for postoperative 6 weeks. Pendulum exercises were allowed to flex the wrist and the elbow for the first 6 weeks, and active assisted passive range of motion exercises were initiated in the subsequent 6 weeks. After 3 months, resistance and strengthening exercises were initiated. Return to sports activity was permitted following postoperative 4 months. Contact sports were allowed 6–9 months following surgery.

Assessment

Follow-ups were performed at 1.5, 3, 6, 12 months and annually thereafter. Patients' demographics were recorded. Surgical reports, and pre- and post-operative radiological and clinical evaluation were performed. Pre- and post-operative pain and functional and clinical outcomes were measured using shoulder range of motion, the Visual Analog Scale (VAS; 0 to 10; 0=no pain to 10= worst pain), American Shoulder and Elbow Surgeons Shoulder Form (ASES) [23], University of California at Los Angeles Shouder Rating Scale (UCLA) [24], Constant-Murley score (CMS) [25], Oxford Instability score (OIS) [26] and Rowe score [27]. Shoulder range of motion (RoM) was recorded at standard physical examinations pre- and postoperatively. For radiological evaluation, standard anterior-posterior (AP) and axillary views were used. Pre-operative axial magnetic resonance imaging (MRI) scan was used to identify the Hill–Sachs lesions and glenoid defects. A three-dimensional computed tomography (CT) scan was performed for patients with glenoid defects on MRI and the defect size was measured by a physician not participating in the operation [28]. Also the Hill-Sachs lesions were intraoperatively evaluated and subjectively described as small, medium, or large in size. Lesions involving greater than 15% of the humeral articular surface in depth were defined as large lesions. Routine postoperative MRI was not performed. Post-operative recurrent instability was assessed asking the patients if a re-dislocation had occured after the operation. While those who answered 'yes' to both questions were classified as dislocation, only those who said 'yes' to the first question were classified as subluxation. The patients were then further evaluated in terms of recurrence status (i.e., (recurrence +) vs (recurrence -). Demographic data, functional and clinical outcome parameters were evaluated according to the recurrence status. Local Ethics Committee approval date was 24/07/2015 and protocol number was 2015/331.

Statistical analysis

SPSS 22.0 for Windows (SPSS Inc., IL, USA) was used for statistical analyses. Kolmogorov-Smirnov test was used to measure variable distribution. Descriptive statistics were presented as highest and lowest values, mean, standard deviation, median, and frequencies. Independent quantitative data was analyzed using Student t-tests and Mann-Whitney u tests. Dependent quantitative data was analyzed using Wilcoxon tests. Qualitative independent data was analyzed using Chi-square or Fischer exact tests. A p-value <0.05 was considered an indication of statistical significance.

Results

67 patients (63 males, 4 females) were included. Mean age was 30.8 ± 7.7 years. The mean follow-up was 87.7 ± 19.1 months (range 60–134 months). Contact sports participation glenoid bone loss, Hill-Sachs lesion, and a smoking habit negatively affected the recurrence status. The clinical characteristics, demographics data and operative features are summarized in Table 1.

Good to excellent postoperative clincal and functional outcomes were obtained regarding VAS, ASES, UCLA, CMS, OIS and Rowe scores; however, poorer results were found in recurrence (+) patients compared with baseline (p<0.001) (Table 2). The postoperative active external rotation degree at 0°, 45° and 90° of abduction and shoulder abduction degree were significantly improved (p<0.001). However, only postoperative abduction degree was significantly higher in recurrence (-) patients compared to recurrence (+) patients. While the preoperative apprehension test at different abduction degrees was not statistically different in terms of recurrence, a significantly higher apprehension test positivity was observed in the recurrence (+) patients postoperatively. Comparisons of RoM and function measurements,and the latest follow-up values are summarized in Table 3.

In the 11 patients (10 male,1 female) with recurrence, 3 patients experienced re-dislocation while 8 patients experienced subluxations. Our patient population consisted of recreational athletes, not amateur or professional-level competitive athletes. While 10 (90.9%) patients with recurrence engaged in contact sports, 1 patient did not participate in contact sports. The mean age was 28.7 ± 5.1 (21-35) years. Recurrence developed in 8 (72.7%) patients who had been operated on the dominant side. While 9 (81.8%) patients were smokers, 2 were not. While 7 (63.6%) patients had 5 or more dislocations before the operation, 4 (36.4%) patients had less than 5 dislocations. Six (54.5%) of the recurrence patients had glenoid bone defect, and 5 (45.5%) had Hill-Sachs lesion. One patient (9.1%) with SLAP lesion experienced recurrence in our recurrence population.

Table 1. Patient characteristics and operative features according to the recurrence status

		Total (Mean + SD / n-%) (range) (n=67)	Recurrence (+) (Mean + SD / n-%) (range) (n=11)	Recurrence (-) (Mean + SD / n-%) (range) (n=56)	P
Age at surgery (yr)		30.8 ± 7.7 (18-45)	28.7 ± 5.1 (21-35)	31.2 ± 8.0 (18-45)	0.321
Age at first dislocation (yr)		28.5 ± 7.7 (17-43)	25.6 ± 4.6 (20-34)	29.1 ± 8.1 (17-43)	0.174
Follow-up period (mo)		87.7 ± 19.1	87.8 ± 15.0	89.6 ± 19.3	0.060
Gender	**Female**	4 (6%)	1 (9.1%)	3 (5.4%)	0.633
	Male	63 (94%)	10 (90.9%)	53 (94.6%)	
Side	**Right**	44 (65.7%)	8 (72.7%)	36 (64.3%)	0.590
	Left	23 (34.3%)	3 (27.3%)	20 (35.7%)	
Side dominancy	**(no)**	20 (29.9%)	3 (27.3%)	17 (30.4%)	0.838
	(yes)	47 (70.1%)	8 (72.7%)	39 (69.6%)	
BMI (kg/m²)		26.3 ± 3.0	26.2 ± 2.9	27.3 ± 3.4	0.183
Smoking Habit	**(no)**	37 (55.2%)	2 (18.2%)	35 (62.5%)	0.007
	(yes)	30 (44.8%)	9 (81.8%)	21 (37.5%)	
Number of instability episodes	**≥5**	33 (49.3%)	7 (63.6%)	26 (46.4%)	0.297
	<5	34 (50.7%)	4 (36.4%)	30 (53.6%)	
Contact sports	**(-)**	24 (35.8%)	1 (9.1%)	23 (41.1%)	0.043
	(+)	43 (64.2%)	10 (90.9%)	33 (58.9%)	
Time from first dislocation to operation (mo)		28.8 ± 18.3 (2- 82)	39.8 ± 24.6 (4-82)	26.7 ± 25.3 (2- 70)	0.164
No. of suture anchors		2.5 ± 0.6 (2-4)	2.5 ± 0.8 (2-4)	2.5 ± 0.6 (2-4)	0.971
Glenoid bone loss	**(-)**	49 (73.1%)	5 (45.5%)	44 (78.6%)	0.023
	< 17%	18 (26.9%)	6 (54.5%)	12 (21.4%)	
Hill-Sachs lesion	**(-)**	54 (80.6%)	6 (54.5%)	48 (85.7%)	0.017
	Small/medium	13 (19.4%)	5 (45.5%)	8 (14.3%)	
SLAP lesion	**(no)**	57 (85.1%)	10 (90.9%)	47 (83.9%)	0.480
	(yes)	10 (14.9%)	1 (9.1%)	9 (16.1%)	
Operative Time (minutes)		54.3 ± 11.4 (35-75)	55.9 ± 9.4 (45-75)	54.8 ± 11.0 (35-75)	0.621

BMI: Body mass index

Table 2. Pain and functional outcome scores according to the recurrence status

Evaluation method	Total (n=67)	Recurrence (+) (n=11)	Recurrence (-) (n=56)	p
VAS score (mean + SD)				
Preoperative	4.4 ± 1.4	4.5 ± 0.5	4.4 ± 1.5	0.895
Postoperative	1.0 ± 1.1	2.7 ± 0.6	0.6 ± 0.7	<0.001
p	<0.001	<0.001	<0.001	
ASES score (mean + SD)				
Preoperative	64.5 ± 7.0	61.3 ± 3.9	65.1 ± 7.3	0.100
Postoperative	84.4 ± 12.4	61.8 ± 6.0	88.8 ± 7.5	<0.001
p	<0.001	0.810	<0.001	
UCLA score (mean + SD)				
Preoperative	18.5 ± 3.6	16.5 ± 1.6	18.9 ± 3.8	0.042
Postoperative	31.1 ± 5.6	19.1 ± 3.0	33.5 ± 1.7	<0.001
p	<0.001	0.036	<0.001	
CM score (mean + SD)				
Preoperative	66.5 ± 7.2	58.7 ± 3.2	67.5 ± 7.1	<0.001
Postoperative	89.0 ± 14.6	61.3 ± 14.3	94.5 ± 6.0	<0.001
p	<0.001	0.591	<0.001	
Oxford instability score (mean + SD)				
Preoperative	23.3 ± 5.0	21.5 ± 2.2	23.7 ± 5.3	0.191
Postoperative	42.2 ± 7.4	26.8 ± 3.8	45.3 ± 2.6	<0.001
p	<0.001	0.001	<0.001	
Rowe score (mean + SD)				
Preoperative	51.2 ± 9.9	51.3 ± 7.7	51.2 ± 10.3	0.973
Postoperative	88.0 ± 16.3	56.8 ± 12.0	94.1 ± 7.9	<0.001
p	<0.001	0.019	<0.001	

VAS: Visual Analog Scale; ASES: American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form; UCLA: University at California at Los Angeles Shouder Rating Scale; CM: Constant-Murley. Bolded P values indicate statistically significant differences between groups (p < 0.05)

Table 3. Comparison of shoulder RoM and function between pre-operative measurements and the respective values at the latest follow-up

Parameter		Total (n=67)	Recurrence (+) (n=11)	Recurrence (-) (n=56)	P value
External rotation at 0° of abduction (mean + SD					
Preop		74.8 ± 8.3	74.0 ± 8.0	75.0 ± 8.5	0.745
Postop		79.4 ± 7.9	76.8 ± 7.8	80.0 ± 7.9	0.230
Pre-post difference p		<0.001	0.025	<0.001	
External rotation at 60° of abduction (mean + SD)					
Preop		79.4 ± 8.6	78.1 ± 8.1	79.6 ± 8.7	0.612
Postop		84.2 ± 8.7	83.6 ± 7.1	84.3 ± 9.0	0.800
Pre-post difference p		<0.001	0.006	<0.001	
External rotation at 90° of abduction (mean + SD)					
Preop		81.5 ± 9.0	78.6 ± 9.5	82.1 ± 8.9	0.243
Postop		87.2 ± 8.8	86.8 ± 8.7	87.3 ± 8.9	0.865
Pre-post difference p		<0.001	0.018	<0.001	
Abduction degree (mean + SD)					
Preop		162.9 ± 11.6	157.7 ± 16.0	164.9 ± 11.3	0.101
Postop		170.7 ± 10.4	159.5 ± 11.9	172.9 ± 8.6	<0.001
Pre-post difference p		<0.001	0.459	<0.001	
Preop apprehension test at maximum abduction at 0° of abduction (n-%)	(-)	26- 61.2%	4- 36.4%	22- 39.3%	0.569
	(+)	41- 38.8%	7- 63.6%	34- 60.7%	
Preop apprehension test at maximum abduction at 45° of abduction (n-%)	(-)	11- 16.4%	2-18.2%	9-16.1%	0.579
	(+)	56- 83.6%	9-81.8%	47-83.9%	
Preop apprehension test at maximum abduction at 90° of abduction (n-%)	(-)	2-3%	0-0%	2-3.6%	0.697
	(+)	65-97%	11-100%	54-96.4%	
Postop apprehension test at maximum abduction at 0° of abduction (n-%)	(-)	58-86.6%	2-18.2%	56 -100%	<0.001
	(+)	9-13.4%	9-81.8%	0-0%	
Postop apprehension test at maximum abduction at 45° of abduction (n-%)	(-)	54-80.6%	1-9.1%	53-94.6%	<0.001
	(+)	13-19.4%	10-90.9%	3-5.4%	
Postop apprehension test at maximum abduction at 90° of abduction (n-%)	(-)	51-76.1%	0-0%	51-91.1%	<0.001
	(+)	16-23.9%	11-100%	5-8.9%	

No significant difference was found between the patients with or without concomitant SLAP repair in terms of postoperative clinical and functional scores, abduction, and external rotation in different degrees, the number of re-dislocations, O'Brien and apprehension tests. The overall recurrent instability rate at the last follow-up was 16.4 % (11/67). Three (4.5%) of such patients had experienced a re-dislocation and other signs of recurrence included patient-reported subluxations in 8 (12.0%) of the 67 shoulders. Five (7.4%) patients with recurrence were re-operated (including two subluxations and three re-dislocations). Four patients underwent a revision ABR, and an open Latarjet procedure was performed for one patient. The remaining six recurrence (+) patients (subluxations) were treated with intensive physical therapy applications until their instability complaints and physical findings disappear. After the revision surgery, no re-dislocations or subluxations occurred. Forty-seven (76.7%) patients could return to preoperative sports activity level. No patients developed superficial or deep infections. No major complications were occurred in peri- or post-operative period.

Discussion

The most important findings of the current study were that ABR is a reliable method with a relatively low recurrence rate and revision need in the mid-term. Also, higher contact sports participation, humeral and glenoid bone loss, smoking habit, and lower preoperative CM and UCLA scores were observed in patients experiencing recurrence after ABR.

Postoperative recurrent instability is the most common and unwanted complication of ABRs [6-8]. Although there are several studies in the literature that evaluate factors affecting failure and recurrence rate after ABRs, there are no studies that thoroughly evaluate the effects of patient characteristics, surgical features, and preoperative clinical and functional values on recurrence in recreational athletes. In this study, we aimed to evaluate these factors in detail.

Different recurrence rates have been reported in studies evaluating long-term outcomes after ABRs. Aboalata et al. [29] reported a recurrence rate of 18.2% after ABRs. However, in other studies, recurrence rates were reported of up to 35% over a 10-year or longer follow-up time [2,30,31]. In a recent study, Komnos et al. [32] reported a recurrence rate of 11.5% at a mean 9 years follow-up in laborers and recreational athletes. In a more diverse population (i.e., athletes, non-athletes, laborers), Zimmermann et al. [33] reported higher recurrence rate and subluxations at 28.4%. The overall recurrence (including re-dislocation or subluxation) rate of ABRs in our study group was 16.4 % (11/67) after a mean 87.7+19.1 months follow up. The recurrence rate in the current study was relatively lower compared to previous reports; we may attribute this finding to the characteristics of our patient population and the relatively low follow-up time.

In the literature, there are several studies evaluating the association between patient characteristics and recurrence after ABRs [8,9,12-17]. Some of these studies reported a higher recurrence rate with glenoid and humeral bone loss [14,15], younger age [9,12,17], participation in contact sports [9,12,16], male gender [12], higher number of preoperative dislocations [12] and bilateral instability [9]. Consistent with some of these findings, we found that contact sports participation; bone loss of glenoid and humerus; and a smoking habit negatively affected the recurrence status. However, a recent long-term study of Ono et al. [8] revealed no significant correlations between patient factors (including bone loss of glenoid/humerus and the other outcome measures) with instability recurrence, except an insignificant correlation with younger age. Consistent with this study, we found no effect of age, gender, BMI, dislocation side, side dominance, number of instability episodes, and time from first dislocation to operation on the recurrence status. We recommend that surgeons be careful when considering ABRs for anterior glenohumeral insability in patients involving in contact sports, with glenoid and humerus bone loss, and who smoke. It is also critical that surgeons inform these patients about the possible higher risk of recurrence or instability in detail.

A SLAP lesion accompanying a Bankart lesion has been reported at a rate of 5–57% in the literature [34]. Additionally, in patients with chronic anterior instability, an increased incidence of combined Bankart and type II SLAP lesions (Type 5) has been found [35]. In our study, 10 (14.9%) patients had SLAP lesions accompanying a Bankart lesion, and of these patients, 8 (80%) had Type SLAP 5 lesions consistent with the literature. In several studies, no clinical difference was found between SLAP (+) and SLAP (-) patients in terms of the RoM, postoperative clinical scores, re-dislocations [4,34,35]. In line with these studies, no significant difference was found between the patients with concomitant SLAP repair or isolated Bankart repair regarding postoperative clinical scores, RoM, the number of re-dislocations, and O'Brien and apprehension tests in our study. We suggest repairing the soft tissues properly in anterior shoulder instability cases regardless of the presence of SLAP lesion.

In this study, postoperative clinical and functional scores and RoM degrees were improved significantly compared to the baseline, regardless of recurrence status. Especially the postoperative active external rotation degree at 0°, 45° and 90° of abduction and shoulder abduction degree were significantly increased compared to baseline values. We attributed this to anxiety of dislocation before surgery. However, as expected, inferior postoperative outcome scores were obtained in patients with postoperative recurrent instabilit. Also, ASES and CM scores did not improve at a significant level in the recurrence (+) patients postoperatively. While other functional scores did not differ in terms of recurrence status, interestingly, preoperative UCLA and CM scores were significantly lower in the patients with recurrence compared to the recurrence (-) patients. According to these findings, recurrence may be higher in patients with relatively low preoperative UCLA and CM scores after ABRs. However, prospective randomized studies evaluating the effect of clinical scores on recurrence after ABRs are needed in a larger patient sample.

Strengths of this study were that the same surgeon with at least 5 years of experience performed all procedures. The surgeon used the same surgical and rehabilitation procedures for all patients. Using the same surgeon can eliminate scientific bias or bias resulting the different surgical technique. Second, we evaluated a large variety of factors; patients' characteristics and demographic data, physical examination and intraoperative factors. Studying the wide range of characteristics and factors presents a complete assessment.

There are several limitations to be mentioned. This was a retrospective study in nature with a medium follow-up period, meaning that long-term functional outcomes and the recurrence rate may differ. More accurate results may be obtained with longer follow-up. In spite of these limitations, the current study might be useful for selecting the right patient and treatment option for ABRs by taking patient characteristics, functional and clinical measures and radiologic evaluation into careful consideration. With the findings of this study, surgeons should try to perform ABRs more carefully in patients with risk factors of recurrence status. In addition, surgeons should inform patients about possible alternative operations in case of recurrence.

Conclusion

Good to excellent clinical outcomes with noticeable improvements in functional scores can be obtained with ABRs. Higher contact sports participation, bone loss of glenoid and humerus, a smoking habit, and lower preoperative CM and UCLA scores must be carefully evaluated when considering ABR and informed about the possible negative effects on recurrence status.

Conflict of interests
The authors declare that they have no competing interests.

Financial Disclosure
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Ethical approval
Local Ethics Committee approval date was 24/07/2015 and protocol number was 2015/331.

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