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Predisposing Factors for Recurrent Shoulder Dislocation After Arthroscopic Treatment

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Background: Arthroscopic repair of anterior dislocation of the shoulder can fail. We hypothesized that patients who are at higher risk for redislocation following repair could be recognized preoperatively on the basis of their clinical history. The purpose of the present study was to identify the risk factors for recurrence in a community-based population of patients with traumatic unidirectional instability that was treated with a single arthroscopic technique.

Methods: From January 2000 to December 2003, 625 patients with anterior unidirectional instability were managed with an arthroscopic Bankart technique, and 385 met the criteria for inclusion in the study. Demographic data were collected, and clinical follow-up was performed at three, six, twelve, twenty-four, and thirty-six months.

Results: At thirty-six months, thirty-one patients (8.1%) had experienced a redislocation; the rate was 13.3% among patients who were twenty-two years of age and younger and 6.3% among older patients. Age at the time of the first dislocation, male sex, and the time from the first dislocation until surgery were significant risk factors for recurrence ($p < 0.05$ for all).

Conclusions: Patients who are more likely to have a redislocation following arthroscopic repair of an anterior shoulder dislocation can be identified preoperatively on the basis of sex, age, and the time from the first dislocation to surgery.

Level of Evidence: Prognostic Level II. See Instructions to Authors for a complete description of levels of evidence.

Forced abduction and external rotation of the shoulder can cause anterior subluxation or dislocation, resulting in anterior instability^{1,2}. Traumatic dislocation of the glenohumeral joint frequently requires surgical repair³. Despite major advances, arthroscopic stabilization techniques are still associated with higher failure rates than traditional open procedures are, especially in young adults⁴⁻⁶. Such failures are reflected in anterior shoulder pain with activities of daily living, which becomes dramatically apparent when the shoulder redislocates⁷. Redislocation has variously been attributed to the type and extent of the capsular lesion⁸, chondral and bone defects⁹, technical errors, insufficient soft-tissue tensioning, an unhealed Bankart¹⁰ or anterior labroligamentous periosteal sleeve avulsion (ALPSA) lesion¹¹, failure of surgical devices^{12,13}, patient age¹⁴ and sex¹⁵, family history⁶, bone quality¹⁶, patient

maturity and self-control¹⁷, participation in highly demanding sports or activities¹⁸, the number of previous dislocations, the type of immobilization, the rehabilitation program⁵, and altered scapular kinematics¹⁹. In the present study of a community-based population²⁰, we hypothesized that patients who are at greater risk for redislocation following arthroscopic repair can be recognized preoperatively solely on the basis of clinical criteria. The purpose of the present study was to identify the risk factors affecting recurrence in patients with traumatic unidirectional instability following treatment with a single arthroscopic technique.

Materials and Methods

A total of 2134 shoulder procedures were performed from January 2000 to December 2003. In this group, 625

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consecutive patients (647 shoulders) with a mean age of 28.7 years (range, sixteen to sixty-three years) had anterior unidirectional instability with a Bankart¹⁰ or an anterior labroligamentous periosteal sleeve avulsion¹¹ lesion. Twenty-two patients (3.5%) had a bilateral procedure. The indications for surgery were recurrent instability and persistent painful apprehension without further dislocations associated with lesions of the anterior-inferior glenoid labrum^{10,11}. All patients were managed by a single surgeon with use of the arthroscopic Bankart technique²¹. The preoperative examination, performed on both shoulders, included the sulcus test, anterior and posterior apprehension and relocation signs, and anterior and posterior drawer signs. The shoulders were evaluated with anteroposterior, axillary, and outlet radiographs as well as with magnetic resonance imaging or magnetic resonance arthrography. The treatment approach was selected on the basis of clinical history and imaging data. Patients who met several criteria were operatively managed and were recruited into the study. These criteria included a traumatic onset of instability, no history of voluntary dislocation, no signs of hyperlaxity, a negative sulcus sign, no elbow hyperextension, no thumb hyperabduction, an interval of less than twelve months after the time of the first dislocation, fewer than seven dislocations, a Bankart or anterior labroligamentous periosteal sleeve avulsion lesion, no glenoid erosion, and no previous shoulder surgery. Professional athletes were not included.

The exclusion criteria were a nontraumatic onset of instability, voluntary dislocation, signs of hyperlaxity, an osseous Bankart lesion or glenoid erosion, lesions requiring more or

fewer than three Mini-Revo screws (ConMed, Largo, Florida) at the time of repair, previous surgical treatment, anatomical variances, and a history of nerve palsy.

Patients were also excluded in the event of intraoperative complications in order to avoid any bias affecting the standard procedure and the consequent outcomes. Of the 647 shoulders that were treated for instability, 422 (65.2%) met the inclusion criteria. As thirty-seven patients (8.8%) were lost to follow-up, the study was conducted on 385 shoulders.

Arthroscopic Treatment: Surgical Technique²¹

The patient was placed in the lateral decubitus position, with the affected arm at 25° of anterior elevation and 75° of abduction; traction of 4 to 6 kg was applied distally, depending on the patient's body mass and physical stature. A posterior portal was used first for diagnostic assessment; then the anterior-superior portal, using the inside-out technique, and finally the anterior-inferior portal, using the outside-in technique, were created. After insertion of the arthroscope through the anterior-superior portal, the labrum was dissected free of scar tissue.

Glenoid labrum lesions (Bankart or anterior labroligamentous periosteal sleeve avulsion lesions) were treated as follows. Three Mini-Revo screws (ConMed) were placed on the anterior-inferior rim of the glenoid from three to five o'clock. The sutures were passed through the inferior glenohumeral ligament and under the detached glenoid labrum with use of a Shuttle Relay (ConMed) and were tied with a sliding knot (Tennessee slider knot²²) to fix and retension the capsular-labral complex firmly to the glenoid. The detached labrum was sutured and was brought into contact with the scapular neck; it

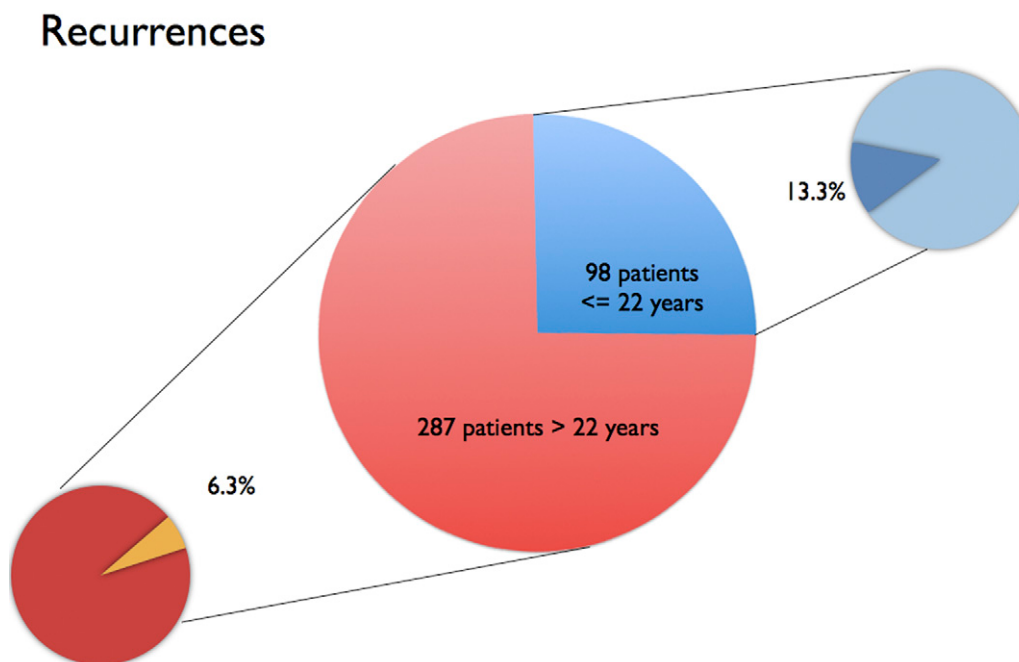


Fig. 1

Patients who were twenty-two years of age or younger accounted for the highest rate of redislocations. Recurrence rates are shown next to the small pie charts.

was then secured to the edge of the articular surface of the glenoid to function as a bumper, thus restoring optimal conditions for concavity compression. Ligament tension was adjusted by grasping the ligament and placing it at different sites on the glenoid until the humeral head was centered on the glenoid.

Postoperative Care

Postoperative management was similar for all patients, and all patients followed the same rehabilitation program. The shoulder was placed in an immobilizer (DonJoy UltraSling II; Smith Nephew DonJoy, Carlsbad, California) for three weeks. Patients then began assisted passive mobilization, avoiding external rotation until the fifth week. At this time, a proprioception recovery program was started. After the fifth week patients began active exercises in a pool and passive mobilization in external rotation, and at eight weeks they started strengthening exercises with a rubber band. Activities of daily living were permitted after ten weeks, and general fitness training (including jogging and noncontact recreational activities) was permitted at twelve weeks. Patients were advised to avoid collision sports and high-risk activities until the sixth month.

Follow-up

Follow-up evaluation was performed at three, six, twelve, twenty-four, and thirty-six months with use of the same protocol as in the preoperative examination. At the first two time points, we assessed the ability to return to activities of daily living and recreational activities, whereas the last evaluation was performed to document any clinical changes. Radiographs were made at twelve and thirty-six months.

Failures

Recurrence of instability, as determined on the basis of either a subjective sense of subluxation or objective documentation of a dislocation, was considered as failure²³.

Statistical Methods

A logistic regression model was developed to investigate the influence of the selected factors on the recurrence of instability, the dependent variable. Variables were eligible for entry into the model if they were significantly ($p < 0.05$) associated with redislocation. The variables that were examined as potential predictors (independent factors) were age at the time of the first dislocation, sex, dominant arm, the side of dislocation, the time from the first dislocation to surgery, the number of dislocation episodes, and the type of glenoid labrum lesion (Bankart or anterior labroligamentous periosteal sleeve avulsion). These variables were studied as dichotomous (value, 0 or 1). The relationship between each of these factors and outcome (recurrence of shoulder instability) was tested with the chi-square test (bivariate analysis).

Source of Funding

No external funding source was used for this study.

TABLE I Bivariate Analysis (Relationship of Variables with Recurrence of Shoulder Instability)

Variable	No. of Recurrences	P Value*
Age (>22 years)		0.03
Absent (n = 98)	13 (13.27%)	
Present (n = 287)	18 (6.3%)	
Male sex		0.02
Absent (n = 107)	3 (2.8%)	
Present (n = 278)	28 (10.1%)	
Dominant arm		0.91
Absent (n = 84)	7 (8.33%)	
Present (n = 301)	24 (7.97%)	
Right side		0.83
Absent (n = 69)	6 (8.70%)	
Present (n = 316)	25 (7.91%)	
Time to surgery (>6 months)		0.01
Absent (n = 209)	10 (4.8%)	
Present (n = 176)	21 (11.9%)	
No. of episodes (>3)		0.49
Absent (n = 176)	16 (9.09%)	
Present (n = 209)	15 (7.18%)	
Lesion type (ALPSA†)		0.09
Absent (n = 253)	16 (6.32%)	
Present (n = 132)	15 (11.36%)	

*Chi-square test. †Anterior labroligamentous periosteal sleeve avulsion.

Results

The study group comprised 385 subjects, including 278 men (72.2%) and 107 women (27.8%). There were no bilateral procedures in the study group. The dominant shoulder was affected in 301 (78.2%) of the 385 patients, and the right shoulder was affected in 316 patients (82.1%). Of the 385 patients, ninety-eight (25.5%) had experienced the first dislocation at the age of twenty-two years or less and 287 (74.5%) had experienced it at a later time. The interval between the first dislocation and the time of surgery was three months or less for ninety-seven patients (25.2%), four to six months for 112 patients (29.1%), seven to nine months for ninety-five patients (24.7%), and ten to twelve months for eighty-one patients (21.0%). The number of dislocations before surgery was one to three for 176 patients (45.7%) and it was four to six for 209 patients (54.3%). At three years after surgery, thirty-one patients (8.1%) had experienced a redislocation.

Redislocations and Age

Among the ninety-eight subjects who were twenty-two years of age or younger at the time of the first dislocation, thirteen had a recurrence (representing 13.3% of the patients who were twenty-two years old or younger and 41.9% of all patients who

had a recurrence). Among the 287 older patients, eighteen had a recurrence (representing 6.3% of the patients who were more than twenty-two years of age and 58.1% of all patients who had a recurrence) (Fig. 1).

Redislocations and Sex

Among the thirty-one patients who experienced a redislocation, twenty-eight (90.3%) were male (representing 10.1% of the 278 male patients in the study) and three (9.7%) were female (representing 2.8% of the 107 female patients in the study).

Redislocations and Dominant Side

Among the thirty-one patients who had a recurrence, twenty-four (77.4%) had redislocation of the dominant shoulder (representing 8% of the 301 patients who had involvement of the dominant shoulder) and seven (22.6%) had redislocation of the nondominant shoulder (representing 8.3% of the eighty-four patients who had involvement of the nondominant shoulder).

Redislocations and Time from the First Dislocation to Surgery

With regard to the time from the first dislocation until surgery, 209 of the 385 patients had surgery within six months and 176 had surgery between seven and twelve months. Among the thirty-one patients who had a redislocation, ten (32.3%) had surgery within six months after the initial dislocation (representing 4.8% of the 209 patients who had surgery within six months) and twenty-one (67.7%) had surgery between seven and twelve months after the initial dislocation (representing 11.9% of the 176 patients who had surgery between seven and twelve months).

Redislocations and the Number of Dislocations Before Surgery

Among the thirty-one patients who experienced a redislocation, sixteen (51.6%) had had one to three dislocations before surgery (accounting for 9.1% of the 176 subjects with one to three previous dislocations) and fifteen (48.4%) had had four to six previous dislocations (accounting for 7.2% of the 209 patients with four to six previous dislocations).

Redislocation and Type of Lesion

The underlying injury was a Bankart lesion in 253 (65.7%) of the 385 patients and an anterior labroligamentous periosteal sleeve avulsion lesion in 132 (34.3%). Among the patients with a Bankart lesion, sixteen patients (6.3%) had a redislocation (representing 51.6% of all thirty-one patients who had a redislocation). Among subjects with an anterior labroligamentous periosteal sleeve avulsion lesion, fifteen (11.4%) had a redislocation (representing 48.4% of all thirty-one patients who had a redislocation).

Multivariate Analysis

Only three variables were found to be associated ($p < 0.05$, chi-square test) with recurrence of shoulder instability: age, sex,

TABLE II Variables Entered into the Logistic Regression Model, Adjusted Odds Ratios, and 95% Confidence Intervals

Variable	Adjusted Odds Ratio	95% Confidence Interval
Age (>22 years)	0.46	0.21 to 0.99
Male sex	3.65	1.08 to 12.39
Time from first dislocation to surgery (>6 months)	2.62	1.19 to 5.79

and the time from the first dislocation to surgery (Table I). These three variables were entered into a multiple logistic regression model (multivariate analysis), and all were found to be significant on the basis of likelihood ratio tests ($p < 0.05$). The Hosmer-Lemeshow goodness-of-fit test indicated that the model was well calibrated ($p = 0.28$). In this test, a large p value indicates that the model was performing well, that is, it excluded a large discrepancy between the observed and the expected recurrence of shoulder instability. The adjusted odds ratios and 95% confidence intervals are listed in Table II. The adjusted odds ratios are controlled simultaneously for all of the other variables entered into the model. Three factors significantly affected recurrence rates: an age of more than twenty-two years at the time of the first dislocation, male sex, and an interval of more than six months between the first dislocation and surgery.

Discussion

The failure of arthroscopic stabilization of recurrent traumatic anterior instability of the shoulder is not a rare event²⁴. Although a variety of arthroscopic repair methods have been described, their failure rates have been relatively high, ranging from 4% to 21%²⁵⁻²⁷. At 8.1%, the three-year redislocation rate in the present study is consistent with the rates in previous reports, demonstrating the reliability of the surgical technique adopted. Our large community-based²⁰ sample (385 shoulders) was analyzed to establish whether it is possible to identify risk factors for redislocation preoperatively as awareness of which patients are more likely to experience redislocation is a clinical advantage for the surgeon.

The core of the study was an attempt to identify epidemiologic and clinical features that could affect the outcome of a standard arthroscopic procedure. Statistical analysis of the data highlighted male sex, an age of twenty-two years or less, and an interval of more than six months between the first dislocation and surgery as significant risk factors for redislocation in patients managed with the arthroscopic Bankart repair technique. The critical age for recurrence after both nonoperative and operative treatment has previously been reported to be twenty years^{4,28-32}. In the present study, the significant cut-off age was slightly older, as patients who were twenty-two years of age or younger had twice the rate of redislocation as did older patients. Therefore, given our study protocol, in which surgical procedures with technical diffi-

culties were excluded, even an apparently appropriate surgical procedure may not prevent redislocation in an important fraction of patients who are twenty-two years of age or younger. In contrast with the findings of previous studies^{13,26} that demonstrated that sex had no influence on the likelihood of redislocation, a significantly larger number of our male patients experienced a redislocation. Male sex is also a risk factor for recurrence after primary traumatic shoulder instability^{30,33}. The risk for redislocation was approximately 3.5 times higher among our male patients than it was among our female patients ($p = 0.02$).

Our findings also highlight a higher risk of redislocation with a longer time between injury and surgery. Patients who were managed more than six months after the first dislocation were 2.6 times more likely to have a redislocation in comparison with those who were managed within six months. Neither the number of previous dislocations nor the type of lesion appeared to have influenced the outcome of arthroscopic stabilization, although the statistical power of the study may be insufficient to make a definitive statement regarding the factors. Unlike Ozbaydar et al.²³, we found that lesion type had no significant influence on outcome, although the percentage of recurrences was indeed greater in association with anterior labroligamentous periosteal sleeve avulsion lesions than in association with Bankart lesions.

The limitations of the present study include its retrospective nature, which prevented the implementation of standardized protocols for preoperative and postoperative assessment. Because a prospective power analysis was not performed, the importance of statistically insignificant findings is difficult to assess, despite the large number of patients and the homogeneous nature of the treatment. In addition, there was no postoperative imaging to assess whether labral repairs had healed. While there were significant differences between patients with an age of twenty-two years or less and those with an age of more than twenty-two years, age was not studied as

a continuous variable, preventing a determination of whether significant increases in risk could be seen at younger ages. The study involved a single surgeon and a consistent surgical technique; however, it is possible that other surgical techniques may lead to different rates of recurrence. The present study was a cohort study without a comparison group and did not include professional or collision athletes. It was a clinical investigation into the factors that may identify patients at potentially higher risk of a redislocation; this is why the variable of high-risk activities was not included as they may arise even in the lives of otherwise sedentary subjects. Nonetheless, a number of our patients may have participated in these types of sports in a recreational fashion. Clearly, a return to collision sports can be a significant risk factor for redislocation; however, we have no data on this variable and could not control for it.

In conclusion, patients who are more likely to experience a redislocation can be identified preoperatively on the basis of basic historical information such as sex, age, and the time from the first dislocation to surgery. ■

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