

# Arthroscopic Versus Open Stabilization for Anterior Shoulder Subluxations

Brett D. Owens,<sup>\*†</sup> MD, Kenneth L. Cameron,<sup>\*</sup> PhD, MPH, ATC, Karen Y. Peck,<sup>\*</sup> MEd, ATC, Thomas M. DeBerardino,<sup>‡</sup> MD, Bradley J. Nelson,<sup>§</sup> MD, Dean C. Taylor,<sup>||</sup> MD, Joachim Tenuta,<sup>¶</sup> MD, and Steven J. Svoboda,<sup>\*</sup> MD

*Investigation performed at the John A. Feagin Jr Sports Medicine Fellowship, Keller Army Hospital, US Military Academy, West Point, New York, USA*

---

**Background:** Most of the literature on shoulder instability focuses on patients experiencing anterior glenohumeral dislocation, with little known about the treatment of anterior subluxation events.

**Purpose:** To determine the outcomes of surgical stabilization of patients with anterior glenohumeral subluxations and to compare open and arthroscopic approaches.

**Study Design:** Randomized controlled trial; Level of evidence, 2.

**Methods:** We prospectively enrolled patients with anterior glenohumeral subluxations undergoing surgical stabilization. Patients were offered randomization between open and arthroscopic stabilization. Inclusion criteria included patients with anterior glenohumeral subluxations undergoing Bankart repair, while exclusions included the presence of glenoid or humeral bone loss, multidirectional instability, capsular tear/humeral avulsion of the glenohumeral ligament lesion, and rotator cuff tear requiring repair. Patients were randomized to an open Bankart repair through a subscapularis takedown or an arthroscopic Bankart repair, both using the same bioabsorbable suture anchors, and they were followed for a minimum of 2 years. Outcomes were evaluated with the Single Assessment Numeric Evaluation (SANE), Western Ontario Shoulder Instability Index (WOSI), American Shoulder and Elbow Surgeons Score (ASES), Simple Shoulder Test (SST), Rowe, and Tegner activity scores.

**Results:** A total of 26 patients were enrolled, with 7 being lost to follow-up. Complete follow-up data were available on 19 subjects (74%): 10 in the open group and 9 in the arthroscopic group. There were no significant differences noted between the randomized groups, with a 2-year WOSI score of 320 in the open subjects and 330 in the arthroscopic subjects, and similar findings in the other scoring scales. There were no cases of dislocation following surgery. There were 3 patients with recurrent instability (subluxations only) in each group at a mean of 17 months, for an overall recurrent subluxation rate of 31%. These subjects with recurrence had lower outcome scores (WOSI, 532; SANE, 88.4). The outcomes of the 9 subjects with  $\leq 3$  subluxation events were superior to those of the 10 subjects with  $> 3$  events prior to stabilization. The patients with  $\leq 3$  events had a WOSI score of 143, compared with 470 ( $P = .042$ ), and an ASES mean score of 98.8, compared with 87.1 ( $P = .048$ ). Four of the 6 patients with recurrent subluxations had sustained  $> 3$  subluxations prior to stabilization.

**Conclusion:** Overall, patients with Bankart lesions resulting from an anterior glenohumeral subluxation event had excellent outcomes with surgical stabilization. The overall recurrence in the 19 subjects with at least 2-year follow-up was 6 cases (31%), with no instances of dislocation in this young, active cohort. There was no significant benefit to open or arthroscopic stabilization, and we did find that stabilization of subluxation patients with  $\leq 3$  events resulted in superior outcomes compared with chronic recurrent subluxation patients with  $> 3$  events. We recommend early surgical stabilization of young athletes with Bankart lesions that result from anterior subluxation events.

**Keywords:** shoulder; subluxation; instability; repair; arthroscopy

---

Shoulder instability is endemic in young athletes and military personnel.<sup>6,7</sup> While the majority of the literature has focused on shoulder dislocation, it is actually shoulder subluxation events that compose 85% of acute traumatic shoulder instability events.<sup>8</sup> It has been shown that

traumatic shoulder subluxation events are not benign injuries and can result in similar pathologic changes to those observed in patients with complete dislocation events.<sup>9</sup>

While the natural history of shoulder dislocation has been extensively studied, the natural history of acute traumatic subluxation events is poorly understood. Owens et al<sup>9</sup> reported on a cohort of 27 young athletes with transient luxation events, 14 of whom underwent surgical stabilization. Of the 11 patients not lost to follow-up, 4 experienced

---

The Orthopaedic Journal of Sports Medicine, 3(1), 2325967115571084  
DOI: 10.1177/2325967115571084  
© The Author(s) 2015

This open-access article is published and distributed under the Creative Commons Attribution - NonCommercial - No Derivatives License (<http://creativecommons.org/licenses/by-nc-nd/3.0/>), which permits the noncommercial use, distribution, and reproduction of the article in any medium, provided the original author and source are credited. You may not alter, transform, or build upon this article without the permission of the Author(s). For reprints and permission queries, please visit SAGE's Web site at <http://www.sagepub.com/journalsPermissions.nav>.

recurrent instability. Although that study was not designed as a natural history study, 72% of patients either underwent surgical stabilization or experienced repeated recurrences.

At our institution, we have treated patients with shoulder subluxations and evidence of a Bankart lesion with surgical stabilization, based on the natural history of shoulder dislocations with similar pathology in our highly active and high-risk population.<sup>11</sup> However, the optimal method of surgical stabilization following shoulder subluxation remains unknown. Therefore, we sought to determine the optimal technique for surgical stabilization of shoulder subluxations in young athletes. We hypothesized that arthroscopic repair would result in a similar recurrence rate but higher subjective outcome scores.

## METHODS

### Design and Setting

In 2003, we initiated a prospective randomized control trial to compare methods of surgical stabilization for patients presenting with shoulder subluxations. Patients with shoulder instability consisting entirely of subluxation events (never experiencing a complete dislocation event requiring a manual reduction maneuver) were offered enrollment into our trial.

Endemic rates of shoulder instability in our population have been previously documented,<sup>8</sup> as have the activity requirements, including either intercollegiate or intramural athletics as well as military and physical education requirements.<sup>5</sup> We obtained institutional review board approval from our institution prior to initiating this study.

### Subjects

Patients presenting with a history of anterior shoulder subluxations and physical examination findings consistent with anterior instability (apprehension sign, relocation sign, load-shift) and magnetic resonance imaging (MRI) evidence of a Bankart lesion (traumatic luxation events<sup>9</sup>) were offered surgical stabilization and were enrolled in this study. Patients underwent diagnostic arthroscopy to confirm the presence of a Bankart lesion and were excluded if any of the following findings were present: glenoid or humeral bone loss, multidirectional instability, capsular tear/humeral avulsion of the glenohumeral ligament (HAGL) lesion, or rotator cuff tear requiring repair. A computer-generated 4-block randomization strategy, stratified by surgeon, was used to assign patients to undergo either arthroscopic Bankart repair or open Bankart repair.

### Surgical Technique

All subjects underwent diagnostic arthroscopy and repair of a superior labrum anterior posterior (SLAP) lesion if present. Patients in the arthroscopic arm were then treated with arthroscopic Bankart repair using suture anchors. The anteroinferior capsule and labrum was mobilized with an arthroscopic elevator, and the anteroinferior glenoid rim and neck were prepared with a mechanical shaver device. Sutures were shuttled across the capsule as well as labrum, starting at the inferior position and progressing in a superior direction using as many suture anchors (3.0-mm Bio SutureTac; Arthrex) as needed.

Subjects randomized to the open repair group underwent a diagnostic arthroscopy with repair of superior labrum as needed. The arthroscope was removed, and an open Bankart repair was performed through a deltopectoral interval incision. The subscapularis was reflected and repaired with permanent sutures after the labral repair. The same anchors that were used in the arthroscopic repair group were also used in the open repair group. The rehabilitation protocol was identical for all subjects, regardless of treatment arm, and consisted of 4 weeks minimum in a sling, progressive strengthening at 12 weeks, and return to sports at 6 months.

### Outcome Measures

Subjects were evaluated at baseline and at follow-up with a battery of subjective outcome measures, including the Single Assessment Numeric Evaluation (SANE), Western Ontario Shoulder Instability Index (WOSI), American Shoulder and Elbow Surgeons Score (ASES), Simple Shoulder Test (SST), Rowe score, and Tegner activity scale. The WOSI score is a 2100-point scale with increasing score reflecting increased limitations in shoulder function. Blinded evaluator follow-up evaluations were performed at 6 weeks, 3 months, 6 months, 1 year, and 2 years. All patients were evaluated by their surgeon at similar time intervals to document any subsequent instability events. In addition, any instability events that were documented in the patient's medical record were identified to ensure that no subsequent events were missed.

### Statistical Analysis

Initially, descriptive statistics were calculated, including means and standard deviations for continuous variables and frequencies and proportions for categorical variables. For ordinal variables or continuous variables that were

<sup>†</sup>Address correspondence to LTC Brett D. Owens, MD, John A. Feagin Jr Sports Medicine Fellowship, Keller Army Hospital, West Point, NY 10996, USA (email: b.owens@us.army.mil).

<sup>\*</sup>John A. Feagin Jr Sports Medicine Fellowship, Keller Army Hospital, US Military Academy, West Point, New York, USA.

<sup>‡</sup>University of Connecticut, Farmington, Connecticut, USA.

<sup>§</sup>University of Minnesota, Minneapolis, Minnesota, USA.

<sup>||</sup>Duke University, Durham, North Carolina, USA.

<sup>¶</sup>Albany Medical Center, Albany, New York, USA.

The views and opinions expressed in this manuscript are those of the author(s) and do not reflect the official policy of the Department of the Army, the Department of Defense, or the US Government.

One or more of the authors has declared the following potential conflict of interest or source of funding: T.M.D. is a consultant for Arthrex; B.D.O. is a consultant for Mitek and the Musculoskeletal Transplant Foundation.

not approximately normally distributed, we calculated medians and interquartile ranges. For continuous variables, independent *t* tests were used to evaluate between-group differences for all outcomes of interest. If the assumptions for the independent *t* test were not met, the nonparametric equivalent, the Kruskal-Wallis test, was used for intergroup comparisons. We used  $2 \times 2$  contingency tables along with the chi-square statistic, or where appropriate, Fisher exact tests, to examine associations between categorical variables. All analyses were performed using Stata SE version 10.1, and a type I error rate established at  $P < .05$ .

## RESULTS

A total of 40 subjects were enrolled, with 14 subjects being excluded for the following reasons: engaging Hill-Sachs lesion ( $n = 1$ ), posterior and anterior tear with bidirectional instability ( $n = 5$ ), multidirectional instability ( $n = 1$ ), absent Bankart lesion ( $n = 3$ ), rotator cuff tear requiring repair ( $n = 2$ ), and posterior labral tear only ( $n = 2$ ). Thus, the number of randomized subjects was 26, with 7 subjects being lost to follow-up. The mean age of the study cohort was 20.6 years. Complete follow-up data was available on 19 subjects (74%): 10 in the open group and 9 in the arthroscopic group. All 10 patients in the open group were male, while there were 7 males and 2 females in the arthroscopic group. The mean number of subluxation events prior to stabilization was 5.7 (range, 1-15) for the open group and 3.4 (range, 1-7) for the arthroscopic group, also not significant. The baseline WOSI scores were 1040 for the open group and 901 for the arthroscopic group ( $P = .53$ ). All patients had Bankart lesions noted at surgery, and 17 had Hill-Sachs lesions.

Both groups experienced significant improvements with surgical stabilization, with the 2-year WOSI scores improving to 320 in the open subjects ( $P = .0001$ ) and 330 in the arthroscopic subjects ( $P = .005$ ). However, the 2-year WOSI scores were not significantly different between groups, with similar findings for the other scoring scales. There were no cases of dislocation following surgery. There were 3 patients with recurrent instability (subluxations only) in each group at a mean of 17 months, for an overall recurrent subluxation rate of 31%. These subjects with recurrence had lower outcome scores (WOSI, 532; SANE, 88.4). The outcomes of the 9 subjects with  $\leq 3$  subluxation events were superior to those of the 10 subjects with  $> 3$  events prior to stabilization: The patients with  $\leq 3$  events had a WOSI score of 143 compared with 470 for those with  $> 3$  events ( $P = .042$ ), and they had a mean ASES score of 98.8 compared with 87.1 ( $P = .048$ ). Four of 6 patients with recurrent subluxations had sustained  $> 3$  subluxations prior to stabilization.

## DISCUSSION

Overall, patients with Bankart lesions resulting from an anterior glenohumeral subluxation event had significant improvements in validated subjective outcomes scores with

surgical stabilization. This study represents a dedicated series of surgical stabilization for shoulder subluxations exclusively (and not a mixed instability cohort), with validated subjective outcome scores. Our results suggest that surgical stabilization can result in consistent clinical improvement in this cohort of active young athletes.

While there were no cases of dislocation in this young, active cohort, the recurrent subluxation rate of 31% is concerning. At the outset of this study, we hypothesized that shoulder subluxation patients would have improved outcomes compared with dislocation patients. We did not find this to be the case, with the mean 2-year SANE score of 90.7 for our entire cohort, compared with a previous study of our patient population with confirmed dislocations studied at 3 years who had a mean SANE score of 95.5.<sup>1</sup>

Our current study did reveal significant benefit to both open and arthroscopic stabilization in this cohort, without a significant difference between these groups. This finding suggests that either an open or arthroscopic approach is acceptable. Previous work in dislocation patients has found superior subjective outcome scores for arthroscopic repair.<sup>3</sup>

Other authors have presented series of patients with traumatic anterior subluxations. Rowe and Zarins<sup>10</sup> reported 60 shoulders in 58 patients with recurrent subluxations. Their report included a mixed population of traumatic and atraumatic instability, with some patients reporting overuse mechanisms. A Bankart lesion was noted in 64% of 50 shoulders undergoing surgery, and 70% "excellent" results were noted. Mizuno and Hirohata<sup>4</sup> reported 45 patients with recurrent traumatic anterior subluxations. Thirty-five patients underwent surgery, including either Bankart repairs or Putti-Platt reconstructions, and 85% had an "excellent" outcome by Rowe criteria. Garth et al<sup>2</sup> reported 30 shoulders in 28 patients with recurrent anterior subluxations. Only 11 patients underwent surgery, and no subjective outcome assessment was reported. Wong and colleagues<sup>12</sup> reported on 31 patients with subluxations; however, only 25 had anterior unidirectional instability. With a minimum follow-up of 2 years following treatment with thermal capsulorrhaphy, they reported an improvement of the mean ASES score from 56 to 88. Our results compare favorably to these previous reports.

Our study does have some limitations. We lost 7 subjects to follow up, leaving 74% of our original cohort for analysis. This is unfortunate but understandable when treating a military patient population that is transient in nature with world-wide assignments and combat deployments, which limit continued involvement in studies such as this. Unfortunately, we were most likely underpowered to make a definitive statement on the relative efficacy of arthroscopic versus open Bankart repair for subluxation patients. However, our results did not show trends in this regard either. Strengths of our study include a young, athletic cohort that has been shown to be at high risk for shoulder instability events. We performed a prospective trial design with instrumented outcome measure analysis.

We did find that stabilization of subluxation patients with  $\leq 3$  events resulted in superior outcomes compared with chronic recurrent subluxation patients with  $> 3$  events. This underscores the importance of early recognition and

treatment of traumatic subluxations to optimize outcomes. We recommend early surgical stabilization of young athletes with Bankart lesions that result from anterior subluxation events.

## REFERENCES

1. DeBerardino TM, Arciero RA, Taylor DC, Uhorchak JM. Prospective evaluation of arthroscopic stabilization of acute, initial anterior shoulder dislocations in young athletes. Two- to five-year follow-up. *Am J Sports Med.* 2001;29:586-592.
2. Garth WP Jr, Allman FL Jr, Armstrong WS. Occult anterior subluxations of the shoulder in noncontact sports. *Am J Sports Med.* 1987;15:579-585.
3. Kirkley A, Griffin S, Richards C, Miniaci A, Mohtadi N. Prospective randomized clinical trial comparing the effectiveness of immediate arthroscopic stabilization versus immobilization and rehabilitation in first traumatic anterior dislocations of the shoulder. *Arthroscopy.* 1999;15:507-514.
4. Mizuno K, Hirohata K. Diagnosis of recurrent traumatic anterior subluxation of the shoulder. *Clin Orthop Relat Res.* 1983;179:160-167.
5. Mountcastle SB, Posner M, Kragh JF Jr, Taylor DC. Gender differences in anterior cruciate ligament injury vary with activity: epidemiology of anterior cruciate ligament injuries in a young, athletic population. *Am J Sports Med.* 2007;35:1635-1642.
6. Owens BD, Agel J, Mountcastle SB, Cameron KL, Nelson BJ. Incidence of glenohumeral instability in collegiate athletics. *Am J Sports Med.* 2009;37:1750-1754.
7. Owens BD, Dawson L, Burks R, Cameron KL. Incidence of shoulder dislocation in the United States military: demographic considerations from a high-risk population. *J Bone Joint Surg Am.* 2009;91:791-796.
8. Owens BD, Duffey ML, Nelson BJ, DeBerardino TM, Taylor DC, Mountcastle SB. The incidence and characteristics of shoulder instability at the United States Military Academy. *Am J Sports Med.* 2007;35:1168-1173.
9. Owens BD, Nelson BJ, Duffey ML, et al. Pathoanatomy of first-time, traumatic, anterior glenohumeral subluxation events. *J Bone Joint Surg Am.* 2010;92:1605-1611.
10. Rowe CR, Zarins B. Recurrent transient subluxation of the shoulder. *J Bone Joint Surg Am.* 1981;63:863-872.
11. Wheeler JH, Ryan JB, Arciero RA, Molinari RN. Arthroscopic versus nonoperative treatment of acute shoulder dislocations in young athletes. *Arthroscopy.* 1989;5:213-217.
12. Wong KL, Getz CL, Yeh GL, Ramsey M, Iannotti JP, Williams GR Jr. Treatment of glenohumeral subluxation using electrothermal capsulorrhaphy. *Arthroscopy.* 2005;21:985-991.