



Although Surgical Techniques Differ, Similar Outcomes Can Be Obtained When Operating After Single Versus Multiple Anterior Shoulder Dislocations

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Purpose: To compare the differences in preoperative pathology, surgical technique, and overall outcomes between patients treated surgically after a single anterior glenohumeral joint dislocation and those undergoing surgery after multiple dislocations. **Methods:** An epidemiologic database was used to identify all patients younger than 40 years undergoing surgery for anterior shoulder instability between January 1, 1994, and July 31, 2016, in a defined geographic area. Patient medical records were reviewed to obtain demographic information, patient history, physical examination findings, imaging findings, clinical progression, surgical details, and outcomes. Comparative analysis was performed between patients who underwent surgery after a single dislocation and those who underwent surgery after multiple preoperative dislocations. **Results:** The study population consisted of 187 patients who had a single anterior shoulder dislocation ($n = 55$) or multiple anterior shoulder dislocations ($n = 132$) prior to surgery. The mean follow-up period was 103.3 months (range, 0.3-328.4 months). Demographic characteristics were not significantly different between groups. Although the presence of Hill-Sachs lesions on radiographs was more common in the multiple-dislocation group (42.1%) than in the single-dislocation group (18.8%, $P = .005$), there were no other significant differences in concomitant pathology between groups. Latarjet procedures were more commonly performed in the multiple-dislocation group (12.5% vs 2.1% in the single-dislocation group, $P = .04$). There were no other significant differences in surgical techniques and characteristics between groups. Rates of survival free from recurrent instability ($P = .790$), revision surgery ($P = .726$), and progression to symptomatic osteoarthritis ($P = .588$) were not significantly different between groups. **Conclusions:** Although patients with multiple dislocations prior to surgery were more likely to show radiographic evidence of Hill-Sachs lesions and undergo the Latarjet procedure than those who received surgery after a single dislocation, no significant differences in outcomes with respect to recurrent instability, revision surgery, or progression to symptomatic osteoarthritis were found between these 2 groups at long-term follow-up. **Level of Evidence:** Level III, retrospective comparative study.

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Shoulder instability can be characterized by disruption of the native static and dynamic stabilizers of the glenohumeral joint, which leads to apprehension, subluxation, or dislocation with associated pain.¹ Owing to the extensive physiological range of motion, minimal osseous contact, and heavy reliance on capsular and soft-tissue constraints for stability, the shoulder is the most commonly dislocated joint in the body.²⁻⁵ Anterior dislocations may account for greater than 95% of all shoulder dislocations.^{2,3} The incidence of anterior shoulder instability (ASI) in the general U.S. population has been reported as 0.08 per 1,000 person-years, with an estimate of 1.69 per 1,000 person-years for military personnel.^{6,7} Additionally, the recurrence rate after an initial instability event has been reported to be as high as 92%, with young, male athletes being most susceptible to recurrent instability.⁷⁻¹²

Controversy remains over the best management practices for patients who present with an anterior instability event. Traditionally, initial treatment consisted of a trial of nonoperative management, followed by surgical intervention if nonoperative management failed.⁵ There has recently been a shift in approach to the optimal treatment for a first-time anterior shoulder dislocation in high-risk patients. Recent studies have suggested superior outcomes after early surgical intervention in an attempt to reduce the risk of recurrent instability and ultimately decrease the risk of further damage to the glenohumeral joint.^{1,3,12-16} In a recent systematic review of randomized controlled trials comparing nonoperative management with operative stabilization after a first-time anterior dislocation by Godin and Sekiya,³ the findings supported early operative management for young, active patients participating in high-demand physical activities. However, there was no conclusive evidence for other patient populations. Other studies have shown comparable outcomes between patients treated operatively and those treated nonoperatively after an anterior instability event.^{11,12,17} Although many studies have separately reported the outcomes of operative management after either a single dislocation event or recurrent instability, few have directly compared the results.^{13,18,19} In a recent systematic review by Barlow et al.,¹⁹ rates of recurrent instability were not significantly different in patients undergoing surgery after a single dislocation versus after multiple instability events. Conversely, Marshall et al.¹³ showed that patients with a single dislocation had lower postoperative instability rates and reoperation rates than patients with recurrent dislocations before surgery.

Given the conflicting results of the aforementioned studies, some confusion remains regarding the outcomes of surgery for the first-time dislocator compared with the recurrent dislocator. Although the study

performed by Marshall et al.¹³ favored early surgery, only patients who underwent arthroscopic Bankart repair were included, which may limit applicability to patients treated with other surgical techniques such as an open Bankart repair or Latarjet procedure. Additionally, the long-term rates of progression to osteoarthritis are limited in these previously published comparative studies. Therefore, the purpose of this study was to compare the differences in preoperative pathology, surgical technique, and overall outcomes between patients treated surgically after a single anterior glenohumeral joint dislocation and those undergoing surgery after multiple dislocations. It was hypothesized that there would be significant differences in preoperative pathology, surgical technique, and overall outcomes between patients with a single anterior glenohumeral joint dislocation and those with multiple anterior glenohumeral joint dislocations.

Methods

After institutional review board approval was obtained from all medical institutions (16-007084 and 042-OMC-16), this population-based study used the Rochester Epidemiology Project (REP) to identify patients younger than 40 years with a diagnosis of ASI. The REP is a medical records linkage system that has collected all health care information for residents of Olmsted County, Minnesota, and surrounding counties from 1966 until present day, provided that these residents interacted with a health care provider in the system.²⁰ The methodology as well as the generalizability of the REP has previously been reported in detail.^{20,21} The health care information provided by the REP includes demographic information, physician-determined diagnostic codes, procedural information, imaging, and all medical records that are obtained directly from the provider's records. A search for diagnostic codes relating to ASI using the REP from January 1, 1994, to July 31, 2016, was conducted. Each patient's medical record was then manually reviewed. A patient was considered to have ASI if there was a clinical diagnosis of ASI and imaging or surgical findings to support the diagnosis. This included either an anterior glenohumeral dislocation on radiography, a Hill-Sachs or bony Bankart lesion on radiography after a history consistent with ASI, an anterior-inferior labral tear on magnetic resonance imaging (MRI), or an intraoperative finding of an anterior-inferior labral tear. A dislocation was defined as complete displacement of the humeral head anterior to the glenoid, whereas a subluxation was considered partial displacement of the humeral head in the anterior direction without complete dislocation of the joint. Patients were excluded if they had multidirectional instability, posterior instability, or primarily a SLAP tear without instability.

Patients were included in this study if they were younger than 40 years at the time of initial instability, had a clinical encounter for acute shoulder injury with a diagnosis of shoulder dislocation, had a documented dislocation, and underwent surgery for ASI. Patients were excluded if they did not undergo surgery or if they had a subluxation (or subluxations) but not at least 1 true dislocation prior to surgery. Patient medical records were reviewed to obtain demographic information, patient history (traumatic vs nontraumatic injury, sports participation, employment as a laborer, laterality, and so on), physical examination findings (range of motion and instability tests), imaging findings (Hill-Sachs lesions, bony Bankart lesions, labral tears, and rotator cuff tears), clinical progression (i.e., the identification of future instability events for the patients and whether they required additional surgical procedures for recurrent instability), surgical details (open vs arthroscopic, labral repair, number of anchors used, bone block augmentation), and outcomes (recurrent instability, revision surgery, and osteoarthritis). All preoperative shoulder MRI scans of patients were reviewed (L.L.K., M.D.L.), and glenoid bone loss was independently measured by 1 of 2 reviewers using the best-fit circle method (ratio of the area absent of bone to the assumed area of the circular portion of the glenoid). Progression of osteoarthritis was defined as the development of symptoms associated with glenohumeral joint degenerative changes shown on radiographs.

Patients who underwent surgical stabilization of the shoulder for ASI were divided into 2 groups: those with a single dislocation prior to surgery and those with more than 1 dislocation prior to surgery. If a patient had a single dislocation with 1 or more subluxations, he or she was included in the single-dislocation group for analysis. Patient demographic characteristics, surgical techniques, and outcomes were analyzed between these 2 groups. For analysis of the number of anchors used in a surgical procedure, only patients for whom the number of anchors used was documented were included.

Statistical Analysis

Univariate analysis including measures of central tendency and dispersion was calculated for demographic, clinical, and imaging variables. We used the Wilcoxon rank sum test for continuous variables and the Fisher exact test for categorical variables. All statistical tests were 2-sided, and $P < .05$ was considered significant. Kaplan-Meier survival analysis was performed for all outcome data. All analyses were performed using SAS JMP software (version 14.0; SAS, Cary, NC).

Results

A total of 187 patients met the inclusion criteria (Fig 1), with a mean follow-up period of 103.3 months (range, 0.3-328.4 months). Of these patients, 55 (29.4%)

underwent surgery after a single dislocation event whereas 132 (70.6%) had multiple dislocations prior to surgery. In the multiple-dislocation group, 29 patients had 2 dislocations prior to surgery, 14 had 3 dislocations, 20 had 4 dislocations, and 69 had 5 or more dislocations. Mean age and body mass index, as well as the proportion of male and female patients, were not significantly different between groups (Table 1). Significant differences between the single- and multiple-dislocation groups were found with respect to mean time from initial dislocation to consultation visit (17.3 months and 45.0 months, respectively; $P < .001$) and mean time from initial dislocation to surgery (24.1 months and 67.1 months, respectively; $P < .001$) (Table 1).

Preoperative radiographs and MRI data were available and reviewed for 174 patients (93.0%) and 134 patients (71.7%), respectively (Table 2). Whereas the presence of Hill-Sachs lesions on radiographs was more common in the multiple-dislocation group (42.1%) than in the single-dislocation group (18.8%, $P = .005$), there were no other significant differences in radiographic or MRI findings between the groups (Table 2). Of note, patients who had 2 or more dislocation episodes tended to have a higher percentage of glenoid bone loss than those with only a single previous dislocation; however, the difference was not statistically significant.

Regarding the surgical technique, a higher proportion of rotator cuff repairs were performed in the single-dislocation group (8.2%) than in the multiple-dislocation group (0%, $P = .005$) (Table 3). However,

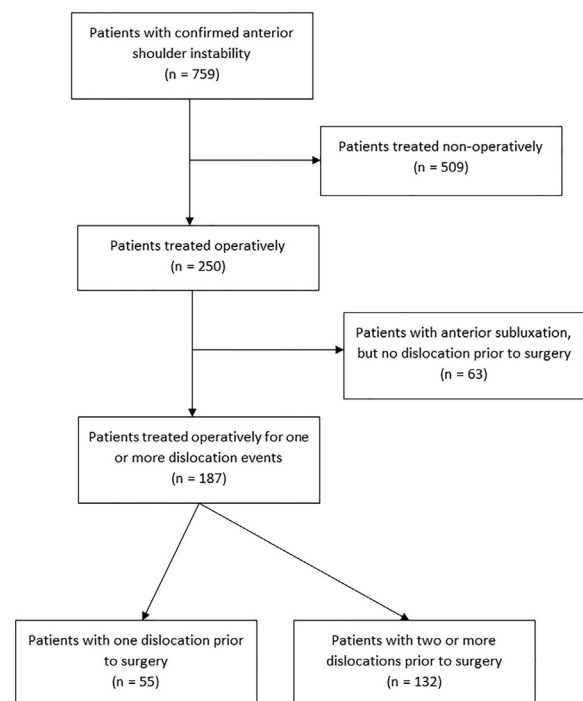


Fig 1. Flowchart depicting study patient selection.

Table 1. Comparison of Patient Demographic Characteristics and Preoperative Characteristics

	1 Dislocation	≥2 Dislocations	P Value
M/F, n	47/8	108/24	.672
Mean age at instability diagnosis, yr	23.0	23.4	.415
Mean BMI	25.3	26.9	.177
Mean time from initial dislocation to consultation visit, mo	17.3	45.0	<.001*
Mean time from initial dislocation to surgery, mo	24.1	67.1	<.001*
Current or former smoker, %	12.2	26.2	.067
Diabetes, %	2.1	0.8	.479
Hyperlaxity, %	8.2	8.7	>.999
Seizure disorder, %	0	2.4	.560
Employment as laborer, %	9.3	14.5	.471
Injured arm: L/R, %	58.5/41.5	54/46	.677
Hand dominance: L/R/B/U, %	3.7/64.8/0/31.5	7.7/63.1/0.8/28.5	.686
Acute trauma, %	94.6	94.6	>.999
Contact sport, %	53.7	46.2	.112

B, bilateral; BMI, body mass index; F, female; L, left; M, male; R, right; U, unknown.

*Significant *P* value ($P < .05$).

Latarjet procedures were more commonly performed in the multiple-dislocation group (12.5% vs 2.1% in the single-dislocation group, $P = .044$). No other significant differences in surgical techniques and characteristics were noted between the groups.

Kaplan-Meier survivorship analysis was performed for survival free from recurrent instability after surgery (Fig 2), revision surgery (Fig 3), and progression to symptomatic osteoarthritis (Fig 4). Survival was defined as no recurrent instability events after surgery, no revision surgery, and no progression to symptomatic osteoarthritis, respectively, for the different survival analyses performed. When we compared patients with 1 dislocation prior to surgery versus those with 2 or more dislocations prior to surgery, the rate of survival free from recurrent

instability after surgery was 96% versus 96% at 12 months, 94% versus 93% at 24 months, 86% versus 90% at 60 months, 81% versus 83% at 120 months, and 81% versus 83% at 240 months ($P = .790$) (Fig 2). The rate of survival free from revision surgery for the single- versus multiple-dislocation groups was 96% versus 96% at 12 months, 94% versus 93% at 24 months, 84% versus 90% at 60 months, 81% versus 83% at 120 months, and 81% versus 83% at 240 months ($P = .726$) (Fig 3). Finally, the rate of survivorship free from progression to symptomatic osteoarthritis for the single versus multiple dislocators was 100% versus 95% at 12 months, 100% versus 95% at 24 months, 96% versus 94% at 60 months, 91% versus 92% at 120 months, and 64% versus 85% at 240 months ($P = .588$) (Fig 4).

Table 2. Comparison of Patient Imaging Characteristics Prior to Surgery

	1 Dislocation, %	≥2 Dislocations, %	P Value
Radiographic imaging			
Baseline arthritis	2.1	2.4	>.999
Hill-Sachs lesions	18.8	42.1	.005*
Bony Bankart lesions	6.3	6.4	>.999
Magnetic resonance imaging			
Posterior-superior labral tear	7.5	9.7	>.999
SLAP tear	20.0	22.6	.822
Posterior-inferior labral tear	5.0	12.9	.227
Anterior-inferior labral tear	88.0	88.2	>.999
Cartilage injury of glenoid	36.4	39.4	.744
Cartilage injury of humeral head	1.8	3.0	>.999
Cartilage injury of both glenoid and humeral head	1.8	1.5	>.999
Biceps tendon pathology	2.5	5.4	.668
Full rotator cuff tear	1.8	0.0	.294
Partial rotator cuff tear	7.3	9.9	.781
Paralabral cyst	7.5	6.5	>.999
Hill-Sachs lesion	90.0	86.0	.778
% of patients with glenoid bone loss	19.2	33.3	.134
Mean % of glenoid bone loss in all patients	2.0	3.4	.130
Mean % of glenoid bone loss in patients with bone loss	10.3	10.2	.963

*Significant *P* value ($P < .05$).

Table 3. Comparison of Surgical Techniques and Characteristics

	1 Dislocation	≥2 Dislocations	P Value
Open vs arthroscopic, %	23.6	36.2	.122
Mean No. anchors	2.9	2.8	.335
>3 anchors used, %	10.9	11.4	>.999
Posterior-superior labral repair, %	4.2	2.3	.615
Posterior-inferior labral repair, %	4.2	1.6	.300
Anterior-inferior labral repair, %	85.7	78.3	.299
Anterior-superior labral repair, %	18.8	10.2	.132
Hill-Sachs repair (remplissage), %	2.1	3.9	>.999
Biceps tenodesis, %	2.1	0.8	.472
Rotator cuff repair, %	8.2	0	.005*
Bone block augmentation (Latarjet procedure), %	2.1	12.5	.044*

*Significant *P* value ($P < .05$).

Discussion

The most important findings of this study were that significantly higher proportions of patients with 2 or more dislocations prior to surgery presented with Hill-Sachs defects on radiographs and underwent the Latarjet procedure compared with patients with a single dislocation prior to surgery. Despite this, satisfactory outcomes were observed in both groups in terms of survivorship free from recurrent instability, revision surgery, and progression to osteoarthritis.

The main significant difference in pathology found in this study was that patients with 2 or more dislocations were more likely to have Hill-Sachs defects on radiographs compared with patients with a single dislocation prior to surgery. Although the true incidence of Hill-Sachs lesions is not fully known, current literature suggests that the incidence is higher with recurrent anterior instability,²²⁻²⁴ which is consistent with our study findings. It is interesting to note that on MRI, there was no significant difference in the presence of Hill-Sachs lesions between groups. This may be because of the increased sensitivity of MRI compared with radiographs, allowing it to identify subtle lesions that were not seen on radiographs in the first-time dislocators.^{25,26} A prospective study by Dickens et al.²⁷ showed a significant increase in bone loss after recurrent instability compared with after a single instability event. Although our study did not specifically evaluate the volume of bone loss in patients, the increased presence of Hill-Sachs defects on radiographs in recurrent dislocation patients is consistent with the previous work.

This study found that significantly more Latarjet procedures were performed in patients with 2 or more dislocations than in those with a single dislocation (12.5% vs 2.1%, $P = .044$). Previous studies comparing patients with a single instability event versus recurrent instability events prior to surgery did not directly compare surgical techniques because many of these studies included only patients undergoing arthroscopic procedures or excluded patients undergoing bone block augmentation.^{13,18,19,28} Although Denard et al.²⁹ did not directly compare surgical treatment of a single dislocation versus recurrent instability, their study showed that patients undergoing the Latarjet procedure for ASI had significantly more dislocations prior to index surgery, their shoulders had been dislocated for a longer period, and they had a higher percentage of bone loss at the time of treatment.^{30,31} It is well documented that significant glenoid bone loss should be addressed at the time of surgery. Burkhart and De Beer³² reported a 4% recurrent instability rate after arthroscopic Bankart repair in patients without substantial bone defects but a 67% recurrence rate in patients with substantial bone defects. In a similar patient population with glenoid bone loss, Burkhart et al.³¹ found only a 4.9% recurrent instability rate after the Latarjet procedure.

Controversy remains over whether to operate after a single instability event or to postpone the operative procedure until multiple instability events have occurred. Much of this controversy may be attributed to the fact that results have varied significantly and studies have shown favorable outcomes for both operative and nonoperative management after a single instability event.^{3,10-16,19,29,33} Advocates for operating after a single instability event argue that recurrent instability rates are significantly higher with nonoperative management compared with surgical stabilization, especially in young, male athletes, with

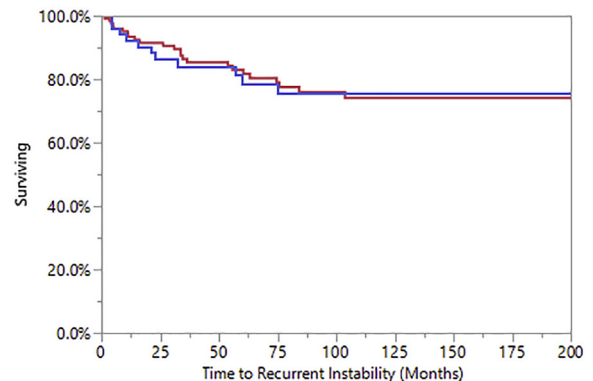


Fig 2. Kaplan-Meier survival analysis showing survival free from postoperative instability in patients with 1 dislocation prior to surgery (blue line) and patients with 2 or more dislocations prior to surgery (red line).

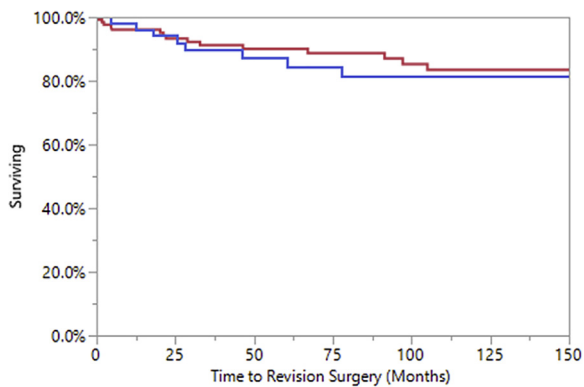


Fig 3. Kaplan-Meier survival analysis showing survival free from revision surgery in patients with 1 dislocation prior to surgery (blue line) and patients with 2 or more dislocations prior to surgery (red line).

several studies showing increased bone loss and damage to the glenohumeral joint after recurrent instability.^{10,16,26,27,33,34} Thus, it is thought that surgical stabilization should be performed to prevent these recurrent instability events in these high-risk patients to prevent further bone loss and damage to the glenohumeral joint. This is a valid concern; however, some studies have shown excellent results after nonoperative management for shoulder instability. Shanley et al.¹⁷ found no significant difference in return-to-sport and recurrent instability rates between high school athletes treated operatively and those treated nonoperatively. On the other hand, Marshall et al.¹³ reported that patients undergoing surgery after first-time dislocations had significantly lower postoperative instability rates. However, they acknowledged that many patients who underwent surgical repair after a single dislocation likely would not have experienced further instability had they been treated nonoperatively. Our study showed that there were no significant differences in survivorship free from recurrent instability between patients who had a single dislocation and those who had 2 or more dislocations prior to surgery. However, this study included multiple surgical techniques with significantly more patients who experienced 2 or more dislocations prior to surgery having undergone the Latarjet procedure. Prior studies have reported reduced recurrent instability rates after the Latarjet procedure compared with Bankart repair.^{35,36} This may account for the similar rates of recurrent instability between groups. Similarly to the findings of this study, a recent systematic review by Barlow et al.¹⁹ showed that there were no significant differences in recurrent instability rates following surgical treatment after primary versus recurrent shoulder instability. They also found that there were no dramatic differences in revision surgery rates between groups, which

is supported by our study as well. Therefore, although it may be advantageous to operate on high-risk patients after a single dislocation event, these results suggest that satisfactory outcomes can be achieved if multiple dislocations have occurred prior to surgery in most patients.

Our investigation also found that there was no significant difference in survivorship free from progression to symptomatic osteoarthritis between groups. To our knowledge, this study is the first to compare rates of symptomatic osteoarthritis after surgery between patients with a single dislocation and those with multiple dislocations prior to surgery. Overall, 16% of patients with a single dislocation prior to surgery progressed to symptomatic osteoarthritis at 20-year follow-up compared with 36% of those in the multiple-dislocation group. Hovelius and Saeboe³⁷ showed that arthropathy developed in 56% of patients at 25 years after an initial shoulder dislocation. The differences in the rates of arthritis observed between these studies may be accounted for by the fact that the study by Hovelius and Saeboe included patients who were treated operatively, as well as patients treated nonoperatively.

Limitations

There were several limitations to our study. First, this study was retrospective in nature, and thus, the findings are limited to the quality of documentation in the patient medical records. Second, the decision to operate, as well as the surgical technique used for treatment, was based on surgeon preference because there was no standardized protocol for this study. Third, the distinction between single and recurrent dislocators was made based on the number of true dislocations rather than subluxations. Accordingly, some patients in the single-dislocation group may have had multiple subluxations prior to surgery. Finally, this study took place over a

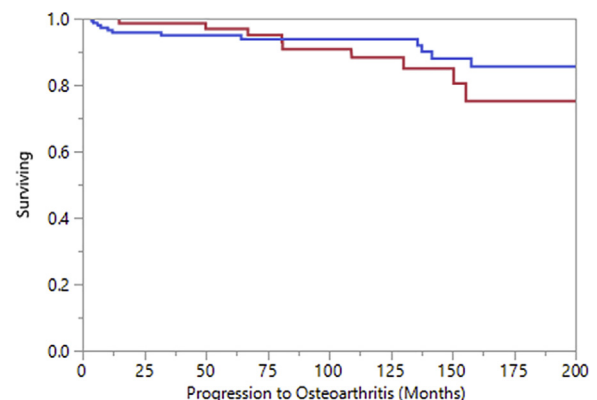


Fig 4. Kaplan-Meier survival analysis showing survival free from progression to osteoarthritis in patients with 1 dislocation prior to surgery (blue line) and patients with 2 or more dislocations prior to surgery (red line).

long period, and thus, changes in surgical technique that have occurred over time may have an impact on outcomes.

Conclusions

Although patients with multiple dislocations prior to surgery were more likely to show radiographic evidence of Hill-Sachs lesions and undergo the Latarjet procedure than those who received surgery after a single dislocation, no significant differences in outcomes with respect to recurrent instability, revision surgery, or progression to symptomatic osteoarthritis were found between these 2 groups at long-term follow-up.

References

- Galvin JW, Ernat JJ, Waterman BR, Stadecker MJ, Parada SA. The epidemiology and natural history of anterior shoulder instability. *Curr Rev Musculoskelet Med* 2017;10:411-424.
- Chan AG, Kilcoyne KG, Chan S, Dickens JF, Waterman BR. Evaluation of the Instability Severity Index score in predicting failure following arthroscopic Bankart surgery in an active military population. *J Shoulder Elbow Surg* 2019;28:e156-e163.
- Godin J, Sekiya JK. Systematic review of rehabilitation versus operative stabilization for the treatment of first-time anterior shoulder dislocations. *Sports Health* 2010;2:156-165.
- Hong J, Huang Y, Ma C, et al. Risk factors for anterior shoulder instability: A matched case-control study. *J Shoulder Elbow Surg* 2019;28:869-874.
- Waterman B, Owens BD, Tokish JM. Anterior shoulder instability in the military athlete. *Sports Health* 2016;8:514-519.
- 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.
- Simonet WT, Cofield RH. Prognosis in anterior shoulder dislocation. *Am J Sports Med* 1984;12:19-24.
- Aronen JG, Regan K. Decreasing the incidence of recurrence of first time anterior shoulder dislocations with rehabilitation. *Am J Sports Med* 1984;12:283-291.
- Henry JH, Genung JA. Natural history of glenohumeral dislocation—Revisited. *Am J Sports Med* 1982;10:135-137.
- Hovelius L, Olofsson A, Sandstrom B, et al. Nonoperative treatment of primary anterior shoulder dislocation in patients forty years of age and younger. a prospective twenty-five-year follow-up. *J Bone Joint Surg Am* 2008;90:945-952.
- Wasserstein DN, Sheth U, Colbenson K, et al. The true recurrence rate and factors predicting recurrent instability after nonsurgical management of traumatic primary anterior shoulder dislocation: A systematic review. *Arthroscopy* 2016;32:2616-2625.
- Wheeler JH, Ryan JB, Arciero RA, Molinari RN. Arthroscopic versus nonoperative treatment of acute shoulder dislocations in young athletes. *Arthroscopy* 1989;5:213-217.
- Marshall T, Vega J, Siqueira M, Cagle R, Gelber JD, Saluan P. Outcomes after arthroscopic Bankart repair: Patients with first-time versus recurrent dislocations. *Am J Sports Med* 2017;45:1776-1782.
- Arciero RA, Wheeler JH, Ryan JB, McBride JT. Arthroscopic Bankart repair versus nonoperative treatment for acute, initial anterior shoulder dislocations. *Am J Sports Med* 1994;22:589-594.
- Bottoni CR, Wilckens JH, DeBerardino TM, et al. A prospective, randomized evaluation of arthroscopic stabilization versus nonoperative treatment in patients with acute, traumatic, first-time shoulder dislocations. *Am J Sports Med* 2002;30:576-580.
- Chahal J, Marks PH, Macdonald PB, et al. Anatomic Bankart repair compared with nonoperative treatment and/or arthroscopic lavage for first-time traumatic shoulder dislocation. *Arthroscopy* 2012;28:565-575.
- Shanley E, Thigpen C, Brooks J, et al. Return to sport as an outcome measure for shoulder instability: Surprising findings in nonoperative management in a high school athlete population. *Am J Sports Med* 2019;47:1062-1067.
- Kim DS, Yi CH, Yoon YS. Arthroscopic repair for combined Bankart and superior labral anterior posterior lesions: A comparative study between primary and recurrent anterior dislocation in the shoulder. *Int Orthop* 2011;35:1187-1195.
- Barlow JD, Grosel T, Higgins J, Everhart JS, Magnussen RA. Surgical treatment outcomes after primary vs recurrent anterior shoulder instability. *J Clin Orthop Trauma* 2019;10:222-230.
- St Sauver JL, Grossardt BR, Yawn BP, Melton LJ III, Rocca WA. Use of a medical records linkage system to enumerate a dynamic population over time: The Rochester Epidemiology Project. *Am J Epidemiol* 2011;173:1059-1068.
- St Sauver JL, Grossardt BR, Yawn BP, et al. Data resource profile: The Rochester Epidemiology Project (REP) medical records-linkage system. *Int J Epidemiol* 2012;41:1614-1624.
- Provencher MT, Frank RM, Leclere LE, et al. The Hill-Sachs lesion: Diagnosis, classification, and management. *J Am Acad Orthop Surg* 2012;20:242-252.
- Taylor DC, Arciero RA. Pathologic changes associated with shoulder dislocations. Arthroscopic and physical examination findings in first-time, traumatic anterior dislocations. *Am J Sports Med* 1997;25:306-311.
- Calandra JJ, Baker CL, Uribe J. The incidence of Hill-Sachs lesions in initial anterior shoulder dislocations. *Arthroscopy* 1989;5:254-257.
- Bishop JY, Jones GL, Rerko MA, Donaldson C. 3-D CT is the most reliable imaging modality when quantifying glenoid bone loss. *Clin Orthop Relat Res* 2013;471:1251-1256.
- Fox JA, Sanchez A, Zajac TJ, Provencher MT. Understanding the Hill-Sachs lesion in its role in patients with recurrent anterior shoulder instability. *Curr Rev Musculoskelet Med* 2017;10:469-479.
- Dickens JF, Slaven SE, Cameron KL, et al. Prospective evaluation of glenoid bone loss after first-time and recurrent anterior glenohumeral instability events. *Am J Sports Med* 2019;47:1082-1089.
- Grumet RC, Bach BR Jr, Provencher MT. Arthroscopic stabilization for first-time versus recurrent shoulder instability. *Arthroscopy* 2010;26:239-248.

29. Denard PJ, Dai X, Burkhart SS. Increasing preoperative dislocations and total time of dislocation affect surgical management of anterior shoulder instability. *Int J Shoulder Surg* 2015;9:1-5.
30. da Silva LA, da Costa Lima AG, Kautsky RM, Santos PD, do Val Sella G, Checchia SL. Evaluation of the results and complications of the Latarjet procedure for recurrent anterior dislocation of the shoulder. *Rev Bras Ortop* 2015;50:652-659.
31. Burkhart SS, De Beer JF, Barth JR, Cresswell T, Roberts C, Richards DP. Results of modified Latarjet reconstruction in patients with anteroinferior instability and significant bone loss. *Arthroscopy* 2007;23:1033-1041.
32. Burkhart SS, De Beer JF. Traumatic glenohumeral bone defects and their relationship to failure of arthroscopic Bankart repairs: Significance of the inverted-pear glenoid and the humeral engaging Hill-Sachs lesion. *Arthroscopy* 2000;16:677-694.
33. Dickens JF, Rue JP, Cameron KL, et al. Successful return to sport after arthroscopic shoulder stabilization versus nonoperative management in contact athletes with anterior shoulder instability: A prospective multicenter study. *Am J Sports Med* 2017;45:2540-2546.
34. Jakobsen BW, Johannsen HV, Suder P, Sojbjerg JO. Primary repair versus conservative treatment of first-time traumatic anterior dislocation of the shoulder: A randomized study with 10-year follow-up. *Arthroscopy* 2007;23:118-123.
35. Blonna D, Bellato E, Caranzano F, Assom M, Rossi R, Castoldi F. Arthroscopic Bankart repair versus open Bristow-Latarjet for shoulder instability: A matched-pair multicenter study focused on return to sport. *Am J Sports Med* 2016;44:3198-3205.
36. Hovelius L, Vikerfors O, Olofsson A, Svensson O, Rahme H. Bristow-Latarjet and Bankart: A comparative study of shoulder stabilization in 185 shoulders during a seventeen-year follow-up. *J Shoulder Elbow Surg* 2011;20:1095-1101.
37. Hovelius L, Saeboe M. Neer Award 2008: Arthropathy after primary anterior shoulder dislocation—223 Shoulders prospectively followed up for twenty-five years. *J Shoulder Elbow Surg* 2009;18:339-347.