



Single anterior shoulder dislocation patients demonstrate higher rates of posterior labral repair and biceps procedures than multiple dislocators at the time of arthroscopic stabilization surgery

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Hypothesis: The purpose of this study is to identify and compare demographic, clinical, historical, and intraoperative variables in patients who have received arthroscopic treatment for single vs. multiple anterior shoulder dislocations.

Methods: This is a retrospective chart review of patients who underwent arthroscopic labral repair of the shoulder by six surgeons at a single institution between 2012 and 2020. Patients with a documented anterior shoulder dislocation were included. Patients with pain-only, subluxation-only, multidirectional or posterior instability, and prior shoulder surgeries of any kind were excluded. Studied variables included age, sex, laterality, body mass index, contact/collision sports, Charlson comorbidity index, tobacco use, number of dislocations ($1, >1$), labral tear size, time from first dislocation to surgery, anchor number, and concomitant procedures. Study groups were compared using student's t-tests and Mann-Whitney U test for continuous variables and chi-square or Fisher's exact tests for discrete variables with a significance of 0.05.

Results: Six hundred thirty-three patients were identified, and 351 (85 single dislocators [SDs], 266 multiple dislocators [MDs]) met inclusion criteria (mean age: 27 years; range: 14–71 years). There were no demographic differences between the study groups. SD received surgery significantly sooner at 17 ± 44 months after injury, while MD received surgery 53 ± 74 months postinitial dislocation. SDs (30/85, 35%) were significantly more likely than MDs (56/266, 21%) to receive concomitant posterior labrum repair. MDs (46/266, 17%) were significantly more likely than SDs (5/85, 6%) to receive a remplissage. SDs (11/85, 13%) were significantly more likely than MDs (11/266, 4%) to receive a concomitant biceps tenotomy/tenodesis. There were no other significant differences in injury or surgery characteristics.

Conclusion: MDs will have more time between their initial dislocation and arthroscopic labral repair and are more likely to receive a remplissage procedure, yet they are less likely than SDs to receive a concomitant posterior labral repair or biceps tenodesis/tenotomy despite no differences in age, sex, and activity level. Whether the greater extent of labrum injury in SD is due to a more severe initial injury vs. earlier recognition and intervention requires further study.

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Shoulder dislocations account for approximately 50% of all joint dislocations, making them the most commonly dislocated joint in the body.^{9,15,26,31,54} The estimated lifetime incidence rate of shoulder dislocation is nearly 24 per 100,000 person-years in the United States.⁶⁴ Of these, anterior dislocations are more common than posterior dislocations.^{1,19,32,40,43,50,52,57,64} The risk factors for recurrence and failure of operative intervention have been extensively studied in anterior shoulder instability cohorts. These have included young age, male sex, contact athletes, and the

presence of humeral or glenoid bone loss, among others.^{5,22,32,43,44,50,54,64} In lieu of this, the optimal approach for a patient with anterior shoulder instability remains debatable due to several factors. These include potentially unsatisfactory outcomes of conservative treatment, high rates of recurrence despite surgical repair, and a lack of appropriate dissemination and implementation of evidence-based medicine regarding first-time anterior dislocations.^{1,3,12,21,36,37,42,45,51} The optimal approach is further complicated in that, until more recently, much of the evidence on outcomes has historically failed to delineate between those who have sustained a single anterior shoulder dislocation compared to those who have experienced multiple dislocations.

Traditionally, initial management of anterior shoulder dislocations proceeded with a trial of nonoperative treatment followed by surgical repair if the nonoperative protocol failed.⁶² More recently, there has been an increasing amount of literature suggesting that surgical intervention following a first-time anterior dislocation is favored in several patient populations.^{1,4,8,11,16,40,41} These findings are contrasted against other studies suggesting comparable outcomes between anterior dislocation patients treated conservatively and those treated surgically.^{61,63} Furthermore, much of the controversy surrounding optimal management for first-time anterior dislocations arises from uncertainty regarding long-term outcomes and risk of recurrence even after surgical repair. For example, several studies support initial Bankart repair surgery over conservative management to address high rates of residual instability following first-time anterior shoulder dislocations.³⁵ However, long-term outcomes following Bankart repair vary significantly. Long-term outcomes following Bankart repair in a meta-analysis by Hurley et al reported a recurrence rate of instability of 9.7% compared to a rate of 67.4% following conservative treatment.³⁵ Other studies conducted by Chahal et al,¹⁴ Eren et al,²⁴ Porcellini et al,⁵¹ and Alkhatib et al³ have shown comparable rates of recurrence. These are contrasted to long-term outcomes observed in a systematic review by Murphy et al. This review showed redislocation following Bankart repair recurred at a rate of 16.0%—although these results were not restricted to Bankart repairs only.⁴⁹ Additionally, 59.4% of patients showed evidence of arthropathy following surgical repair. The results of these studies continue the debate as to whether operative management is the best strategy for first-time anterior shoulder dislocations.

The major concern about conservative treatment of anterior shoulder dislocations is the relatively high rates of recurrent instability and potential negative implications of such on glenohumeral bone quality. However, labral repair of multiple dislocators is also not without its complications.^{1,11,33,34,55} The failure rates of arthroscopic stabilization of recurrent traumatic anterior instability of the shoulder range between 4% and 21%.^{17,30,47,51,58}

Given these concerns and controversies presented above, recent studies have attempted to compare and contrast the risk factors, surgical approaches, and outcomes of single anterior shoulder dislocations and multiple dislocations separately. However, robust data with direct comparisons of the two groups regarding demographics, instability history, and surgery characteristics are lacking.^{7,27,38,48} Therefore, the purpose of this study is to identify and compare demographic, clinical, and perioperative variables in patients receiving arthroscopic treatment for single vs. multiple anterior shoulder dislocations. We hypothesize that patients with single dislocations will have received intervention in a timelier fashion from their injury, and those with multiple dislocations will be more likely to have concomitant pathology/procedures (in addition to the anterior labral tear) at the time of anterior labral repair.

Methods

This single-center study was approved by the institutional review board. A retrospective chart review was performed for consecutive patients who underwent arthroscopic labral repair surgery by six surgeons for anterior shoulder instability between 2012 and 2020. The electronic medical records were reviewed for demographic data, injury data, instability history, activity level, and comorbidities. Operative reports were reviewed to confirm tear size, implant usage, and concomitant procedures. Only patients with a history of anterior dislocation that received an arthroscopic surgical repair were included. Exclusion criteria were patients without a true dislocation event (ie, subluxation or pain-only on presentation), a primary diagnosis of multidirectional instability or posterior instability, and prior shoulder surgeries of any kind. Demographics and operative variables included age, sex, laterality, body mass index, participation in contact/collision sports, Charlson comorbidity index, tobacco use, number of full dislocations (1, >1), time from first dislocation to surgery, number of anchors used for repair, and concomitant procedures performed.

Statistical analysis

All analyses were conducted in Excel 16 (Microsoft, Redmond, WA, USA) and SPSS 29 (IBM Corp., Armonk, NY, USA). Data were analyzed for normality using the Kolmogorov-Smirnov test, and parametric and nonparametric tests were used as appropriate depending upon data normality. Categorical data were compared between groups using chi-square tests and Fisher's exact tests depending on cell populations. Continuous data were compared between groups using Student's t-tests and Mann-Whitney U tests as appropriate depending on data normality. After the exclusion of multidirectional instability patients and revision surgeries, we compared patients with a singular anterior dislocation event to those with multiple anterior dislocation events. Two-tailed tests were performed in all cases, and *P* values of < .05 were considered significant.

Results

Six hundred thirty-three (633) patients were identified as having received an arthroscopic labral repair. Of the patients, 351/633 (55.5%) met inclusion criteria including single dislocators (SDs) (85/351, 24.2%) and multiple dislocators (MDs) (266/351, 75.8%). There were no statistically significant differences in the demographics variables between the two groups including age at surgery, sex, laterality, involvement with contact/collision sports, body mass index, Charlson comorbidity index, and tobacco use (Table 1). In the SD group, the time from dislocation to surgery was 17 ± 44 months compared to the MD group, where the time from first dislocation to surgery was 53 ± 74 months ($P < .001$).

Thirty-five percent (30/85) of the patients in the SD group had a concomitant posterior labral repair in addition to their anterior repair, compared to 21% (56/266) of the MD group ($P < .008$). The SD group was also more likely to receive a concomitant biceps procedure (tenodesis or tenotomy) (11/85, 13%) than the MD group (11/266, 4%) ($P < .004$). Seventeen percent (46/266) of the MD patients received a remplissage procedure, whereas 6% (5/85) of the SD patients received a remplissage procedure ($P < .009$). Other concomitant procedures including superior labral repair, 360-degree labral repair, number of anchors, capsular plication, humeral avulsion of the glenohumeral ligament repair, subacromial decompression, rotator cuff repair, and distal clavicle excision were not statistically significant between the two groups (Table 2).

Table I
Demographics and instability histories comparing those with a single dislocation to those with multiple dislocations, excluding multidirectional instability and posterior instability and only including those with a full dislocation.

Type	Variable	First-time dislocators	Recurrent dislocators	P value
Demographics	Age at surgery (yr)	28 ± 11	26 ± 10	.588
	Male	80% (68/85)	75% (199/266)	.329
	Right side	56% (42/75)	57% (138/243)	.904
	Contact/collision athlete	37% (31/85)	48% (128/266)	.060
	Body mass index (BMI)	26 ± 5	26 ± 6	.475
	Charlson comorbidity index (CCI)	0 ± 0	0 ± 1	.391
	Tobacco use	12% (10/85)	17% (44/266)	.288
Instability history	Time from first dislocation to surgery (mo)	17 ± 44	53 ± 74	<.001

Categorical variables are shown as % (N), and continuous variables are shown as mean ± standard deviation. Significant differences are bolded.

Table II
Surgical characteristics comparing those with a single dislocation to those with multiple dislocations, excluding multidirectional instability and posterior instability and only including those with a full dislocation.

Type	Single dislocators	Multiple dislocators	P value
Surgical characteristics			
Posterior repair	35% (30/85)	21% (56/266)	.008
Superior repair	7% (6/85)	10% (27/266)	.395
360° repair	1% (1/85)	3% (8/266)	.352
Number of anchors	4 ± 1	4 ± 1	.067
Capsular plication	37% (31/85)	44% (117/266)	.222
HAGL repair	5% (4/85)	2% (4/266)	.101
Remplissage	6% (5/85)	17% (46/266)	.009
Subacromial decompression	4% (3/85)	1% (3/266)	.137
Rotator cuff repair	5% (4/85)	3% (7/266)	.339
Distal clavicle excision	1% (1/85)	0% (1/266)	.393
Biceps tenodesis/tenotomy	13% (11/85)	4% (11/266)	.004

HAGL, humeral avulsion of the glenohumeral ligament.

Categorical variables are shown as % (N), and continuous variables are shown as mean ± standard deviation. Significant differences are bolded.

Discussion

In this review of 351 patients, we identified and compared the demographics, instability histories, and surgical characteristics of arthroscopic stabilization surgery after a history of single or multiple anterior shoulder dislocations. The most critical findings of this study were that patients with multiple anterior shoulder dislocations will have more time between their first dislocation and arthroscopic labral repair and more often receive a remplissage, yet multiple dislocators are less likely to have concomitant procedures such as posterior labral repair or biceps tenodesis/tenotomy. Thus, our hypothesis was only partially confirmed as it pertains to surgical timing, and the postulation that multiple dislocators would have more concomitant pathology was rejected.

In this series, the time between the initial anterior shoulder dislocation and surgery is nearly three times as long for those who suffered multiple dislocations compared to those with only a single dislocation (approximately 4.5 years vs. 1.5 years, respectively). Other studies have reported remarkably variable time intervals between the initial dislocation and surgical intervention among diverse patient cohorts. For example, a prospective study by Habermeyer et al reported mean preoperative histories for patients with a single dislocation at 0.8 months, 1-3 dislocations at 29.1 months, 4-6 dislocations at 48.9 months, and >6 dislocations at 79.3 months.²⁹ Kim et al reported shorter intervals of 14.2 days and 25.3 months for single dislocation and recurrent (>1) dislocation groups, respectively.³⁸ Lastly, a systematic review comparing surgical outcomes after primary vs. recurrent anterior shoulder instability of level I and level II studies by Barlow et al showed time

intervals from first dislocation to surgery as short as 5 days for a single dislocation and as long as 6.4 years for recurrent (>1) dislocation.⁷ Our finding in the context of the vast range of times to surgery reported in other studies could correlate with the controversy that remains about optimal management for single and recurrent anterior shoulder dislocations, which begins with the decision to proceed with operative or nonoperative treatment. Electing between operative and nonoperative management for first-time anterior shoulder dislocation largely consists of deliberating the lower risk of another dislocation against the cost and the longer initial recovery associated with surgery.^{18,36,60} However, how to go about weighing the risk of another dislocation often convolutes the shared decision-making process between a patient and surgeon, as the specific risk varies widely from 10% to 90%.⁵⁹

Further compounding the debate surrounding optimal management follows a recent study by the Hutyra et al group, who found that patients with first-time dislocations often receive insufficient information to decide about their management. Namely, a large number of patients—50% out of 1755—with a first-time anterior shoulder dislocation fail to follow up with appropriate specialized care providers or receive evidence-based care recommendations. Critical findings from that study worth noting include physician estimates of the risk of redislocation within a 2-year window aligned with medical evidence 59% of the time. Moreover, only 29% of patients obtained information for first-time anterior shoulder dislocation that aligns with high-level medical evidence. We speculate that the lack of shared evidence-based medicine and follow-up with a healthcare provider could further explain the differences in time to surgery for single and recurrent shoulder dislocations. Further research is needed in that regard.

Interestingly, in our study, 13% of patients with single dislocations also had a biceps procedure, as compared to 4% of >1 dislocations. We speculate that this could be for one or several reasons. First, one possible explanation is that single dislocation patients were selected for surgery because dislocation occurred secondary to a higher energy mechanism, and this possibly resulted in a greater degree of labral pathology and resultant need for concomitant procedures, including posterior labral repairs and biceps tenodesis/tenotomy. This, in turn, could prompt a surgeon to be more likely to recommend surgery after a single dislocation—an inherent selection bias of this study. Other dislocation literature may have more insight into this finding. For example, Eichinger et al found in a cadaveric study that anterior-inferior dislocation direction requires less energy for a dislocation and less risk for associated pathology than a direct anterior dislocation.²³ Another related consideration, while highly speculative and especially vulnerable to selection bias, is the difference in the prevalence of superior labrum anterior-to-posterior (SLAP) lesions between single dislocations and the recurrent dislocation group. Biceps tenodesis is a viable option for SLAP tears in many cases, with some arguing that it has better or comparable outcomes than SLAP lesion

repair.^{10,20} A higher prevalence of SLAP lesions in the single dislocations group would likely explain the higher rate of biceps procedures. A 2023 study by Eren et al found that the prevalence of SLAP lesions was higher in a primary instability group compared to a recurrent instability group—43.9% and 28.6%, respectively. They postulated that early intervention with surgery in patients with primary instability may lead to early detection of a SLAP lesion.²⁵ Recurrent instability may also be more associated with III and IV SLAP lesions that usually do not require a biceps procedure. A 2010 study by Kim et al found that patients with recurrent dislocations were more likely to have type III and IV SLAP lesions compared to primary dislocators.³⁸

Our study also found that 35% of those with a single dislocation also had a posterior labrum repair, whereas 21% of those with >1 dislocation had an accompanying posterior labrum repair. Our findings are opposed to a level II prognostic study by Gutierrez et al, who showed that 36% (16/45) of patients with single anterior dislocations had a posterior labral tear compared to 47% (24/51) of patients with recurrent (>1) dislocations.²⁸ Moreover, Baker et al saw posterior labral pathology in 24% (11/45) of patients with first-time anterior shoulder dislocations.⁶ Given that primary instability is associated with change in the glenohumeral joint, subsequent dislocations are often possible after lower energy mechanisms than a primary dislocation.⁵³ These findings are in line with our previous discussion/speculation that patients with single dislocations could correlate with a more significant amount of energy/mechanism during their dislocation event compared to patients with recurrent dislocations. Specifically, a more significant amount of energy/mechanism could explain why patients with a single dislocation had a higher likelihood of posterior labral tear and subsequent repair compared to patients with >1 dislocation in our study cohort. Although, admittedly, these are also potentially limited by selection bias.

While patients with a single dislocation had higher rates of both biceps procedures and posterior labral repairs, patients with recurrent dislocations had higher rates of remplissage procedures than did the single dislocation group. These results follow that there is higher prevalence of clinically significant Hill-Sachs lesions in recurrent dislocations compared to single dislocations.^{13,39,56} There have been several proposed surgical approaches to treat a Hill-Sachs bone defect following anterior shoulder dislocation and remplissage procedure is among the most common.¹³ There is also a considerable amount of research suggesting remplissage and Bankart repair are superior to Bankart repair alone in patients with anterior shoulder dislocations with accompanying Hill-Sachs lesions.^{2,13,35,46} Specifically, a meta-analysis by Camus et al in 2018 showed that combined Bankart repair and remplissage decreased rates of recurrent instability (defined as redislocation only) by 4-fold compared to isolated Bankart repair in patients with anterior shoulder dislocation.¹³

This study has several limitations. This is a retrospective case study. The sample size is limited, although 351 consecutive patients is one of the largest single-institutional studies to date. This dataset reflects the practices of the six surgeons and may not be generalizable to other settings. Additionally, the surgeon selection bias is inherent to the concomitant procedures reported and the decision-making involved regarding such procedures. There is also a selection bias as to who went into arthroscopic surgery as compared to nonoperative treatment or an open procedure. We did not stratify patients based on mechanism of primary dislocation event, thus obscuring correlations of time intervals to surgery and concomitant procedures performed. Furthermore, we did not record and compare differences in pathology type (ie, anterior labrum periosteal sleeve avulsion lesions, Hill-Sachs lesions, etc.) or pathology characteristics (eg, labrum tear size) identified before surgery between the single

dislocation group and the multiple dislocation group. There is also no data explaining the time interval between initial dislocation and surgery, such as delayed presentation of symptoms, an initial trial of conservative management/therapy, and time between the initial evaluation with the orthopedic surgeon and ultimate surgery. Moreover, we categorized patients into 1 or >1 dislocations and did not further categorize number of dislocations into >2, >3, etc. Lastly, within this study, we did not delineate the specific types of contact sports the patients were engaged in, which assumes similar mechanisms of stress that are not generalizable to all contact athletes. Future studies are planned in that regard.

Conclusion

Multiple anterior dislocation patients who received arthroscopic anterior labral repair had more time between their initial dislocation and repair and were more likely to receive a remplissage procedure, yet were less likely than single anterior dislocators to receive a concomitant posterior labral repair or biceps tenodesis/tenotomy despite no differences in age, sex, and activity level. Whether the greater extent of labrum injury in single dislocators is due to a more severe initial injury vs. earlier recognition and intervention requires further study.

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