Arthroscopic Posterior Stabilization and Anterior Capsular Plication for Recurrent Posterior Glenohumeral Instability

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Purpose: The purpose of this study was to evaluate the outcomes and identify predictors of success for arthroscopic posterior Bankart reconstruction with modern suture anchor repair and anterior capsulolabral plication in a well-defined patient population—recurrent, traumatic, involuntary, unidirectional posterior shoulder instability. **Methods:** Patients with recurrent, traumatic, involuntary, unidirectional posterior shoulder instability who underwent arthroscopic repair with a minimum of 2 years' follow-up were identified and evaluated retrospectively with outcome measures in the form of objective and subjective scores. Statistical analysis was performed to identify predictors of success with significance set at .05. **Results:** Twenty-nine consecutive patients with a mean age of 26.3 years underwent posterior reconstruction and anterior balancing capsulolabral plication as needed with a mean follow-up of 5.5 years. Outcome scores averaged as follows: American Shoulder and Elbow Surgeons, 90.7; University of California, Los Angeles, 32.6; Simple Shoulder Test, 11.7; and Western Ontario Shoulder Instability, 82.9% of normal. Recurrent instability occurred in 3.4% of patients, 84.6% returned to sports, and 96.6% of patients believed surgery was successful and worthwhile. Patients who were younger (<30 years) or patients with more extensive pathology who required additional surgical procedures or received supplemental anterior plication sutures had less reliable or worse outcomes ($P \leq .041$). **Conclusions:** In a traumatic patient population with involuntary, unidirectional posterior shoulder instability, modern suture anchor repair of posterior labral lesions is effective and provides reliable outcomes. Younger patients and patients with worse pathology who required additional procedures had less reliable outcomes. Patients with supplemental anterior plication had more postoperative pain, and this adjunctive procedure may not be necessary for traumatic posterior labral tear surgery. **Level of Evidence:** Level IV, therapeutic case series.

Compared with anterior shoulder instability, posterior shoulder instability is less common and more difficult to diagnose clinically.[1,2] It can present as instability or primarily as pain.[3,4] The spectrum of pathology is broad, and patients can be classified by cause, volition, and direction.[1,5-8] Recurrent traumatic, involuntary, unidirectional posterior shoulder instability is the most common form.[1,3,7,9] The treatment for patients with posterior shoulder instability varies significantly[10-13] and most recently has involved arthroscopic techniques.[2-4,8,14-19] However, because of the rarity of this diagnosis, reports often include a spectrum of patients, differing surgical pathologies, and numerous surgical techniques.[2,4,6,8,14-16,19-22] Even patients with a clinical diagnosis of traumatic posterior shoulder instability may have posterior labral repairs treated with suture anchors or simply undergo capsulolabral plication because of an intact-appearing posterior labrum.[15,16,19]

We report on a series of patients with a well-defined clinical diagnosis (traumatic, involuntary, unidirectional posterior shoulder instability) and corresponding surgical pathology (detachment of the posterior

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labrum or posterior Bankart lesions) and uniform treatment (suture anchor repair). This is a strictly defined series of patients who all had traumatic posterior Bankart lesions and all underwent modern suture anchor repair. This study requires a minimum of 2 years' follow-up and, to our knowledge, reports the longest mean follow-up for arthroscopic posterior instability reconstruction techniques. The purpose of this study is to evaluate the outcomes and identify the preoperative and intraoperative variables that affect outcomes of arthroscopic modern suture anchor repair and supplemental anterior capsulolabral plication in patients with traumatic, involuntary, unidirectional posterior shoulder instability. We hypothesize that patients with traumatic, involuntary, unidirectional posterior shoulder instability who undergo arthroscopic modern suture anchor repair with supplemental anterior capsulolabral balancing will have postoperative Western Ontario Shoulder Instability (WOSI) scores (% of normal) and a return-to-sports rate greater than 80%.

METHODS

Patients who underwent posterior Bankart reconstructions with a minimum of 2 years' follow-up were identified from the senior authors' practices. This initial list included 39 patients. Of these, 34 were available for follow-up and evaluation and 5 patients were unable to be contacted. One patient was excluded because the primary diagnosis was a large glenoid fracture. Three patients were excluded because of a diagnosis of bidirectional instability. One patient with previous open anterior instability surgery was excluded. No patients with multidirectional instability were included in the study. This left a total of 29 patients for the current study.

Posterior instability was diagnosed when all 4 specific criteria were met for each patient: (1) historical symptoms suggestive of posterior instability; (2) correlative physical examination findings (reproduction of symptoms with jerk testing or posterior drawer testing, posterior joint line tenderness) or radiographic findings (reverse Hill-Sachs, posterior labral or bony injury); (3) translation of the humeral head posteriorly over the glenoid rim with or without lock out with an examination under anesthesia (EUA); and (4) posterior labral tear on arthroscopy.

Additional anterior instability was diagnosed if 4 specific criteria were met: (1) historical symptoms suggestive of anterior instability, (2) correlative physical examination findings (reproduction of symptoms with apprehension testing or anterior drawer testing) or radiographic findings (Hill-Sachs or Bankart lesions), (3) translation of the humeral head with an EUA anteriorly over the glenoid rim with or without lock out, and (4) anterior labral tear on arthroscopy.

Patients in whom there was no clinical suspicion of anterior instability (lacking criteria 1 and 2) and who did not have anterior labral tears (criterion 4) but had anterior laxity with 50% anterior humeral head laxity or greater with an EUA were not defined as having anterior instability. They were defined as having asymptomatic anterior laxity or a secondarily stretched anterior capsule that was not primarily pathologic. Anterior laxity with EUA in isolation does not define anterior or bidirectional instability.[23-25] These patients lacked physical examination findings and arthroscopic findings suggestive of anterior instability. These patients who had asymptomatic anterior laxity ($\geq$50% anterior humeral head laxity with EUA) underwent anterior capsular plication. The grade of laxity testing under anesthesia was not a strict criterion for instability. Instability required reproduction of symptoms with laxity testing and correlative clinical or arthroscopic data.

Demographics (age at time of surgery, gender, operative extremity, and dominant extremity), mechanism of injury if any, primary complaint (pain, instability, or pain and instability), Workers' Compensation status, volition, previous surgery if any, and follow-up length were recorded. Patients were evaluated with the American Shoulder and Elbow Surgeons (ASES) rating scale,[26] the WOSI index,[27] the University of California, Los Angeles (UCLA) shoulder score,[28] and the Simple Shoulder Test (SST).[29]

Patients were examined in person at the final follow-up. The senior authors often attract patients from outside the immediate area and so the data for out-of-state patients were collected over the phone.

The level of athletics the patient participated in at the time of injury (professional, college, high school, recreational), the ability to return to sports, and the athletic level of return were also recorded. If patients were unable to return to their athletics or to their previous level of athletics, we asked whether it was because of their shoulder.

In addition, patients were asked to subjectively rate their postoperative range of motion (ROM), strength, pain, and instability. ROM and strength were graded on scale from 0 to 3 as described by Bradley et al.,[8] with 0 representing no strength or poor ROM and 3 representing normal strength or normal ROM. Pain and instability were scored on a scale from 0 to 10,

with 0 representing no pain or no instability and 10 representing extreme pain or extreme instability.

The operative notes were also reviewed to acquire all intraoperative data. The number of anchors used, the addition of anterior capsulolabral plication, additional procedures performed (SLAP [superior labral anterior and posterior] repair, distal clavicle resection, PASTA [partial articular supraspinatus tendon avulsion] repair, and so on) and associated pathologies (reverse Hill-Sachs lesions, significant cartilage defects or bony posterior Bankart lesions, and so on) were also noted.

A statistical analysis was performed. Data were analyzed in a descriptive and inferential manner. Results are presented as mean values for quantitative variables and as absolute and relative frequencies for qualitative variables. Comparison of preoperative to postoperative strength, ROM, stability, and pain was performed by use of an independent *t* test. Outcome variables assessed included pain, ASES scores, UCLA scores, postoperative strength, postoperative ROM, postoperative instability, WOSI total scores, WOSI percent of normal, patient satisfaction with surgery, new dislocation rates, patient's postoperative level of athletics, and patient's ability to return to the previous level of sports. Each of these outcome variables was evaluated with respect to independent variables: Workers' Compensation status, surgeon, age, operative arm, mechanism of injury (major *v* minor repetitive trauma), reverse Hill-Sachs lesions, anterior plication, and additional procedures required. An independent *t* test was used to assess quantitative variables and a χ^2 or Fisher exact test for qualitative data. The level of statistical significance for all statistical tests was set at .05. All tests were performed by use of Stata software (StataCorp, College Station, TX).

Operative Technique

After general anesthesia, the patient is placed in the lateral decubitus position and secured with a bean bag. An EUA is performed to assess the direction and degree of instability. After sterile preparation, the arm is placed in a padded sleeve with approximately 10 lb of in-line traction for glenohumeral suspension. A standard posterior portal is made, and the glenohumeral joint is entered. An anterosuperior portal is created by an outside-in technique. A systematic and routine 15-point examination of the shoulder is performed with visualization posteriorly and anteriorly. The presence of the posterior Bankart lesion is confirmed (Fig 1), and redundancy of the anterior and posterior capsule is assessed. An additional anterior mid-glenoid (AMG) portal is subsequently made with an inside-out technique. If the patient has excessive anterior capsular redundancy and greater than 50% anterior subluxation of the humeral head under EUA, an anterior capsulolabral plication is performed first to supplement the posterior Bankart reconstruction.

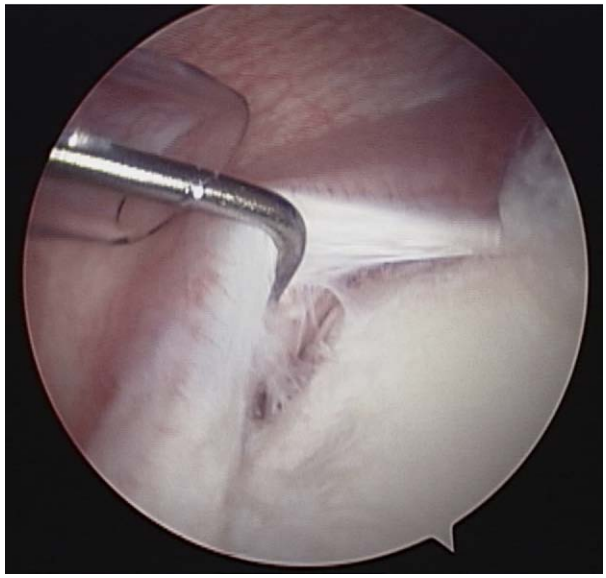

Figure 1. A systematic 15-point glenohumeral arthroscopy shows a typical posterior labral tear.

With the arthroscope in the anterior superior portal, a working cannula is placed in the AMG portal. The synovium is excoriated with a rasp to create a favorable healing surface. A curved 45° Spectrum suture hook (Linvatec, Largo, FL) is used to perform an anterior plication by use of a pinch-tuck technique. Medial-to-lateral and inferior-to-superior capsular shifts are performed as subsequent pinch-tuck passes are made from an inferior-to-superior direction. Either simple sutures or more complex patterns such as figure-of-8 suture configurations are used and stored within Suture Savers (Linvatec) for tying after the posterior Bankart reconstruction. The anterior plication sutures are loosened and stored within the Suture Savers to prevent closure of the capsular fold, thereby impeding visualization for the posterior reconstruction.

Next, the posterior portal will be used as the working portal for the curved suture hook, whereas the AMG portal will be the suture retrieval portal. The posterior labrum is typically debrided of loose fragments with a shaver or biting basket. The glenoid edge is prepared with a shaver and/or bur after the labrum

is released from the glenoid margin with a sharp elevating instrument. It is often most efficient to pass the Liberator elevator (Linvatec) through the AMG portal across the joint to begin the posterior labrum mobilization. A stout, blunt-tip Steinmann pin is used to "pry" open and fully release the posterior labrum from the glenoid. Often, it is necessary to create a special "posterior lateral" portal to ensure the best angle to insert anchors. This portal location is chosen carefully by inserting a spinal needle 2 cm from the posterolateral corner of the acromion and observing the direction and angle it makes approaching the posterior glenoid rim. A small-diameter cannula can be inserted (or simply the drill guide) over a guide rod following the line of the needle.

The most inferior bioabsorbable anchor is inserted by drilling and tapping the pilot hole under direct visualization at approximately the 6:30 position. Subsequent anchor sites are prepared from an inferior-to-superior fashion with the number of anchor holes drilled depending on the size of the tear. The most inferior anchor is placed first, and the suture limb closest to the labrum is retrieved out the AMG portal. A curved 45° suture hook is then used to perform a pinch-tuck purchase of capsule inferiorly in a fashion similar to the anterior plication sutures. The suture is shuttled and tied by use of a sliding-locking knot. Subsequent anchor placement and suture passing and tying are performed as necessary (Fig 2). Once the posterior Bankart lesion has been repaired, the anterior plication sutures are tied. The posterior portal may be also closed with an absorbable monofilament suture.

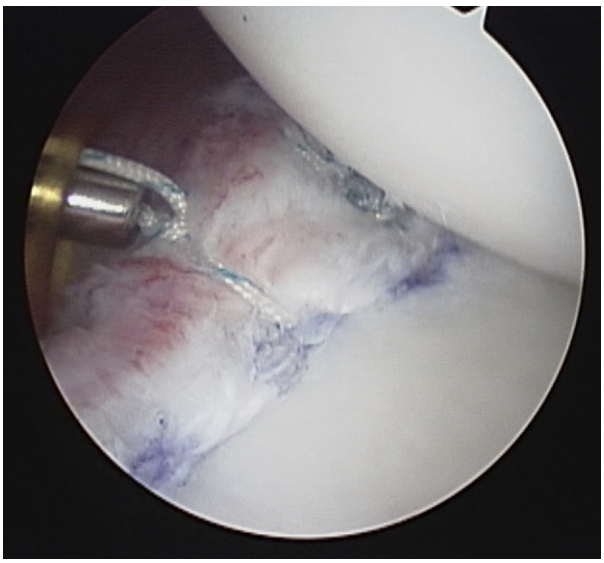

FIGURE 2. After anchor placement and knot tying, the posterior labral tear is repaired from an inferior-to-superior direction.

TABLE 1. *Patient Demographics (N = 29)*

Demographics	Data
Mean age (yr)	26.3 (range, 18.3-43.4)
Men	96.6% (28/29)
Left shoulders	69.0% (20/29)
Nondominant shoulders	69.0% (20/29)
Workers' Compensation	24.1% (7/29)
Previous surgery	0% (0/30)
Mean follow-up (yr)	5.5 (range, 2.0-12.4)

Wounds are closed with an absorbable poly-filament suture in an inverted fashion with bandage strips and a sterile dressing. A 15° external rotation UltraSling (DonJoy, Carlsbad, CA) is used postoperatively for 4 weeks, and gentle ROM exercises are initiated during this time period. Formal physical therapy begins at 4 weeks.

RESULTS

We evaluated 29 patients in this study (Table 1). The mean age was 26.3 years of age (range, 18.3 to 43.4 years). Of patients, 97% (28 of 29) were men. Of operative shoulders, 69% (20 of 29) were left shoulders. Of operative shoulders, 69% (20 of 29) were nondominant shoulders. Of patients, 24% (7 of 29) were involved with Workers' Compensation. No patients had previous surgery. The mean follow-up was 5.5 years (range, 2.0 to 12.4 years).

Of patients, 52% (15 of 29) reported their primary complaint was instability and pain. Pain was reported as the primary concern by 21% of patients (6 of 29). Instability was reported as the chief complaint by 28% (8 of 29) (Table 2). A traumatic origin was reported in 100% (29 of 29) of patients. Of patients, 83% (24 of

TABLE 2. *Clinical Description of Posterior Instability (N = 29)*

Description	Data
Instability as chief complaint	27.6% (8/29)
Pain as chief complaint	20.7% (6/29)
Instability and pain as chief complaint	51.7% (15/29)
Traumatic etiology	100% (29/29)
Macrotrauma	82.8% (24/29)
Repetitive microtrauma	17.2% (5/29)
Volitional/muscular/habitual instability	0% (0/29)
Bidirectional instability	0% (0/29)
Multidirectional instability	0% (0/29)

Table 3. *Operative Data (N = 29)*

Operative Pathology/Procedure	Data
Posterior Bankart lesions	100% (29/29)
Mean No. of suture anchors	2.37 (range, 1-4)
Reverse Hill-Sachs lesions	17.2% (5/29)
Significant posterior glenoid bone or cartilage injury	41.4% (12/29)
Supplemental anterior capsulolabral plication	44.8% (13/29)
Additional procedures performed	52% (15/29)

29) recalled 1 significant traumatic episode as the origin of their symptoms. The other 17.2% of patients (5 of 29) reported a number of smaller traumatic events or repetitive microtrauma as the etiology of their problems. No patients had volitional muscular or habitual posterior shoulder instability (Table 2). No patients had bidirectional or multidirectional shoulder instability. All patients had an EUA consistent with unidirectional posterior shoulder instability.

Of patients, 97% (28 of 29) reported playing sports preoperatively before their injury: 3% (1 of 29) played at the professional level, 17.2% (5 of 29) played at the collegiate level, 24.1% (7 of 29) played at the high school level, and 51.7% (15 of 29) played at the recreational level.

At the time of surgery, 100% of patients (29 of 29) had complete detachment of the posterior labrum (Table 3). All patients underwent suture anchor repair of their labral tears with a mean of 2.4 anchors (range, 1 to 4 anchors). Of patients, 17% (5 of 29) had reverse Hill-Sachs lesions and 31% (9 of 29) had additional significant articular cartilage or bony posterior Bankart lesions. Supplemental anterior capsulolabral plication was performed in 45% of patients (13 of 29). In 52% of patients (15 of 29), additional pathology was addressed at the time of surgery (Table 4).

Table 4. *Additional Procedures Performed (N = 29)*

Procedure Performed	Data
SLAP repair	17.2% (5/29)
RHAGL repair	6.9% (2/29)
Rotator interval closure	6.9% (2/29)
PASTA debridement	6.9% (2/29)
PASTA repair	3.4% (1/29)
SLAP debridement	3.4% (1/29)
Mumford	3.4% (1/29)
Glenoid microfracture	3.4% (1/29)

Abbreviations: RHAGL, reverse humeral avulsion of glenohumeral ligament; PASTA, partial articular supraspinatus tendon avulsion.

Table 5. *Outcome Measures (N = 29)*

Outcome Measures	Data
Satisfied and better with treatment	96.6% (28/29)
Treatment successful	96.6% (28/29)
Surgery worthwhile and would repeat	96.6% (28/29)
Recurrent instability	3.4% (1/29)
Mean ASES score	90.7 (28/29)
Mean UCLA score	32.6 (28/29)
Mean SST score	11.7 (28/29)
WOSI total score	
Mean	359 (range, 0-1,033)
% of normal	82.9% (range, 50.8%-100%)
WOSI physical symptoms score	
Mean	185 (range, 0-611)
% of normal	81.5% (range, 38.9%-100%)
WOSI sports/recreation/work score	
Mean	56 (range, 0-180)
% of normal	87.3% (range, 55%-200%)
WOSI lifestyle score	
Mean	43 (range, 0-170)
% of normal	89.2% (range, 57.5%-100%)
WOSI emotions score	
Mean	80 (range, 0-240)
% of normal	72.0% (range, 20%-100%)
Return to sports	84.6% (22/26)
Return to previous athletic level	68% (17/25)
If unable to return to previous athletic level, unable to return because of shoulder	75% (6/8)

Of patients, 96.6% (28 of 29) reported feeling satisfied and better versus not satisfied and worse (Table 5). Similarly, 96.6% of patients (28 of 29) believed the treatment was successful, and 96.6% of patients (28 of 29) believed the surgery was worthwhile and would repeat it if necessary. Recurrent subluxations or feelings of instability were noted in 1 patient of 29, or 3.4%. The mean postoperative ASES score was 90.7 (range, 53.3 to 100). The mean postoperative UCLA score 32.6 (range, 24 to 35). The mean postoperative SST score was 11.7 (range, 10 to 12). The mean WOSI score was 359 (range, 0 to 1,033) or 82.9% (range, 50.8% to 100%) of normal. The mean WOSI physical symptoms score was 81.5% (range, 38.9% to 100%) of normal, the mean WOSI sports/recreation/work score was 87.3% (range, 55% to 100%) of normal, the mean WOSI lifestyle score was 89.2% (range, 57.5% to 100%) of normal, and the mean WOSI emotions score was 72% (range, 20% to 100%) of normal.

We found that 85% of patients (22 of 26) were able to return to sports (Table 5). Moreover, 68% of patients (17 of 25) were able to return to their previous

Table 6. *Subjective Patient Strength, ROM, Instability, and Pain Scores*

Variable	Postoperative Score (N = 29)
Strength (range, 0-3)	2.6 ± 0.46
ROM (range, 0-3)	2.7 ± 0.48
Instability (range, 0-10)	0.98 ± 1.33
Pain (range, 0-10)	1.3 ± 1.80

NOTE. Data are presented as mean ± SD.

level of athletics. Of those who could not return to their previous level of athletics, 75% (6 of 8) reported that they were unable to return because of their shoulder.

The subjective postoperative mean pain score was 1.3 (range, 0 to 7) (Table 6). The subjective postoperative mean instability score was 0.98 (range, 0 to 4.5). The subjective postoperative mean strength was 2.6 (range, 2 to 3). The subjective postoperative mean ROM was 2.7 (range, 2 to 3).

Patients aged equal to or greater than 30 years reported greater subjective postoperative strength ($P = .008$) and lower instability scores ($P = .041$) compared with patients aged less than 30 years (Table 7). The mean strength score for patients aged greater than 30 years was 2.9 (range, 2 to 3), whereas the mean score for patients aged less than 30 years was 2.6 (range, 2 to 3). The mean instability score for patients aged greater than 30 years was 0.5 (range, 0 to 2), whereas the mean score for patients aged less than 30 years was 1.1 (range, 0 to 4.5). Patients aged less than 30 years had higher subjective pain scores that approached significance ($P = .055$).

Patients with additional surgery performed at the time of surgery had significantly higher pain scores ($P = .001$), lower ASES scores ($P < .001$), lower UCLA scores ($P < .001$), higher subjective instability scores ($P < .001$), higher WOSI scores ($P = .0002$), or lower score for WOSI percentage of normal ($P = .0002$) (Table 8). We also found that patients reported higher subjective pain scores if they required an additional supplemental anterior capsulolabral plication ($P = .0001$) (Table 9). The mean subjective visual analog scale pain score for those who received anterior plication was 1.75 (range, 0 to 7), whereas patients without the procedure reported a mean pain score of 0.78 (range, 0 to 4.5). Patients receiving anterior plication also had lower postoperative strength scores that approached significance ($P = .055$).

Table 7. *Age and Subjective Strength and Instability Scores*

Variable	Age		*P* Value*
	<30 yr (n = 19)	>30 yr (n = 10)	
Postoperative strength	2.6 ± 0.48	2.9 ± 0.09	.00780
Instability	1.1 ± 1.4	0.5 ± 0.2	.041

NOTE. Data are presented as mean ± SD.
*Two-sample *t* test.

Table 8. *Patients With Additional Procedures and Outcome Scores*

Variable	Additional Procedures		*P* Value*
	Yes (n = 15)	No (n = 14)	
ASES	88.4 ± 3.4	95.1 ± 1.7	< .001
WOSI total	246.8 ± 47.2	183.4 ± 35.9	.0002
WOSI total %	88.2 ± 2.2	91.2 ± 1.7	.0002
UCLA	31.8 ± 0.95	34.1 ± 0.34	< .001
Pain	1.5 ± 0.54	0.78 ± 0.35	.0001
Postoperative instability	1.30 ± 0.41	0.5 ± 0.20	< .001

NOTE. Data are presented as mean ± SD.
*Two-sample *t* test.

DISCUSSION

Recurrent posterior subluxation is the most common form of posterior shoulder instability. Posterior shoulder instability has been reported to occur with an incidence of 11.6% among surgically treated instability patients.[1,4] A traumatic origin accounts for the majority of these patients.[1,4] Recurrent posterior subluxation may occur from 1 traumatic event or occur with repetitive stress or microtrauma. This often occurs when a forward flexed arm is axially loaded or posteriorly driven, applying shear stresses to the posterior capsulolabral complex.[3] This has been reported to occur in contact athletes and football lineman with worsening of symptoms with bench pressing.[3] An atraumatic origin raises the possibility of a collagen

Table 9. *Anterior Plication and Subjective Pain Scores*

Variable	Anterior Plication		*P* Value*
	Yes (n = 13)	No (n =16)	
Pain	1.75 ± 0.63	0.78 ± 0.34	.0001

NOTE. Data are presented as mean ± SD.
*Two-sample *t* test.

disorder and ligamentous laxity or a bony abnormality.[1]

Posterior shoulder instability patients can also be classified according to volition and direction. Patients who can volitionally subluxate or dislocate their shoulders on muscular command may have underlying psychiatric or secondary gain issues and are not ideal surgical candidates.[1,30,31] These patients are distinct from the traumatic patient group. Similarly, patients with instability in multiple directions are distinct from patients with primary posterior instability. Within posterior shoulder instability, there is a significant spectrum of patient groups, and it is important to distinctly identify each patient's subgroup.

Patients with differing forms of posterior shoulder instability have various pathologies.[4] Savoie et al.,[2] in their large group of posterior shoulder instability patients, reported that 51% of patients had a posterior Bankart lesion, 67% had a stretched posterior capsule, and 16% had a combination of the 2. Wolf and Eakin[4] noted that 57% of their patients had detachment of the posterior labrum. Kim et al.[15] reported that all of their patients in their series of traumatic unilateral posterior shoulder instability patients had varying degrees of posteroinferior labral lesions. Williams et al.[17] reported that all of their patients with traumatic posterior shoulder instability had detachment of the posterior labrum. The pathoanatomy present at the time of arthroscopy may be an indication to the subset of posterior shoulder instability present in the patient. Patients with traumatic shoulder instability may be more likely to have posterior Bankart lesions, whereas patients with other etiologies may not. Capsular redundancy may be the primary lesion in patients with atraumatic instability.[15]

Suture anchors are used to repair a torn labrum, whereas a patulous capsule receives a different surgery, capsulolabral plication. To our knowledge, nearly all reports of recurrent posterior shoulder instability have had a mixture of such patients or surgical techniques.[2,8,15,16,19] Bradley et al.[8] reported that 44% of patients had capsulolabral plication without suture anchors, 39% had capsulolabral plication with suture anchors, and 17% had capsulolabral plication with suture anchors and additional plication sutures. Kim et al.[15] used suture anchors or capsulolabral plication depending on the patient. Williams et al.[17] and Mair et al.[3] reported on a uniform clinical and pathoanatomic group but used bioabsorbable tack fixation for their surgery. This study includes only those patients with discrete posterior labral tears and documented posterior instability. All patients had a distinct history of trauma, with 82.8% of patients (24 of 29) reporting a major traumatic event. All patients underwent suture anchor repair of their posterior Bankart lesions. We report on a very specific patient group that is clinically and pathoanatomically well defined and treated uniformly with suture anchors.

Our results for modern suture anchor repair in this patient group show good outcomes. We report a mean postoperative ASES score of 90.7 (range, 53.3 to 100), UCLA score of 32.6 (range, 24 to 35), SST score of 11.7 (range, 10 to 12), and WOSI score of 359 (range, 0 to 1,033), or 82.9% of normal (range, 50.8% to 100%). Of the patients, 96.6% (28 of 29) were satisfied and better, believed the surgery was worthwhile and would repeat it if necessary, and believed the treatment received was successful. Recurrent feelings of instability after surgery were reported by 3.4% of patients (1 of 29). The senior author (S.J.S.) and colleagues[32] reported using a similar technique for anterior glenohumeral instability and reported comparable good outcomes. They reported a mean SST of 11.2, mean WOSI index of 85.6%, postoperative dislocation of 7%, 90% return to previous athletics, 100% satisfaction rate, and 100% of patients reporting they would undergo the same procedure again.

Bradley et al.[8] reported that 89% of their patients were able to return to their sports, and 67% of patients who did return to their sports were able to return to their previous level. Our results are similar in that 84.6% of our patients (22 of 26) were able to return to their sports and 68% (17 of 25) were able to return to the same level of athletics.

It has been reported that posterior instability patients have significantly greater chondrolabral and osseous retroversion.[8] Provencher et al.[16] found that patients with voluntary instability and those with prior surgery had worse outcomes. The analysis of our data showed additional factors as predictors of success. Patients with additional procedures performed had worse outcomes. These additional procedures were often performed to address more extensive instability pathology. Six patients possessed posteroinferior labral tears that extended superiorly into a SLAP tear, 4 patients required supplemental instability surgery (RHAGL [reverse humeral avulsion of glenohumeral ligament] repairs or rotator interval closures), and 1 patient underwent a glenoid microfracture for large posterior glenoid cartilage loss. We believe the worse outcome scores for patients who received additional procedures are because these patients had more significant injuries and required supplemental procedures.

Interestingly, patients with supplemental anterior capsulolabral plication reported higher pain scores. They reported a postoperative pain score of 1.75 (range, 0 to 7) versus 0.78 (range, 0 to 4.5) ($P = .0001$). These were performed in patients who had greater anterior laxity (anterior translation >50% of humeral head) with EUA and visual signs of anterior capsular redundancy. It may be that these patients are similar to those who receive additional procedures to address more extensive posterior instability pathology (i.e., a stretched anterior capsule). They may have more pain because their injuries are more significant. Another possibility is that these anterior plication sutures may be restricting their motion, causing pain. The plication is performed to reduce their anterior translation and balance the shoulder, but it may not be necessary to treat their posterior pathology. The magnitude of the increase in pain score is small but still significant. As such, we have started to perform the supplemental anterior plication less and cannot conclude that it is essential.

We also found patients aged greater than 30 years had significantly increased postoperative strength ($P = .0078$) and lower subjective instability scores ($P = .041$) compared with the younger cohort. They also had lower pain scores that approached significance ($P = .055$). However, the magnitude of difference is small, with a mean increase of 0.3 for subjective strength and 0.6 for instability. We believe the younger patient may be more demanding of his or her shoulder and report these small subjective differences.

The strengths of our study include a precisely defined clinical and pathoanatomic patient population that is treated with modern suture anchor repair. The spectrum of patients who have posterior shoulder instability is large, and it is important to correctly identify the specific patient group. Second, the postoperative analysis of this patient group is broad, including validated outcome scores, subjective patient scores, recurrent instability rates, and an analysis of return to sports. This report gives a comprehensive postoperative analysis of the patient group and treatment. Third, statistical analysis has identified a number of variables that may correlate with outcome. Fourth, the follow-up for this study required a minimum of 2 years, with the mean follow-up being 5.5 years.

A weakness of our study is the small number of patients, which may prohibit a more conclusive analysis. The study also lacks a comparative group. However, given the incidence of this diagnosis and our strict inclusion criteria, we believe that it is important to report our current findings. A third weakness is the lack of preoperative outcome scores and patient subjective scores. We would ideally be able to measure an interval change. Fourth, a few patients were out of state, and data collection was performed over the phone instead of in person.

CONCLUSIONS

In a traumatic patient population with involuntary, unidirectional posterior shoulder instability, modern suture anchor repair of posterior labral lesions with supplemental anterior capsulolabral plication as needed is effective and provides reliable outcomes. Younger patients and patients with worse pathology who required additional procedures had less reliable outcomes. Supplemental anterior plication resulted in patients with a higher subjective pain score and may not be necessary.

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