Outcomes of Shoulder Instability Surgery in Competitive Wrestlers

Outcomes, Reoperations, and Return to Play at 5 Years' Mean Follow-up

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Background: Wrestling is a physically demanding sport with young athletes prone to traumatic shoulder instability and a paucity of data evaluating the results of shoulder instability surgery (SIS).

Purpose: To assess reoperation rates, patient-reported outcomes, and return to wrestling (RTW) after SIS in a cohort of competitive wrestlers.

Study Design: Case series; Level of evidence, 3.

Methods: All competitive wrestlers with a history of shoulder instability and subsequent surgery at a single institution between 1996 and 2020 were identified. All directions of shoulder instability (anterior shoulder instability [ASI], posterior shoulder instability [PSI], and traumatic multidirectional shoulder instability [TMDI]) were analyzed. Exclusions included revision SIS and <2 years of follow-up. Athletes were contacted for determination of complications, RTW, and Western Ontario Shoulder Instability Index scores.

Results: Ultimately, 104 wrestlers were included with a mean age at initial instability of 16.9 years (range, 12.0-22.7 years), mean age at surgery of 18.9 years (range, 14.0-29.0 years), and a mean follow-up of 5.2 years (range, 2.0-22.0 years). A total of 58 (55.8%) wrestlers were evaluated after a single shoulder instability event, while 46 (44.2%) sustained multiple events before evaluation. ASI was the most common direction (n = 79; 76.0%), followed by PSI (n = 14; 13.5%) and TMDI (n = 11; 10.6%). Surgical treatment was most commonly an arthroscopic soft tissue stabilization (n = 88; 84.6%), with open soft tissue repair (n = 13; 12.5%) and open bony augmentation (n = 3; 2.9%) performed less frequently. RTW occurred in 57.3% of wrestlers at a mean of 9.8 months. Recurrent instability was the most common complication, occurring in 18 (17.3%) wrestlers. Revision SIS was performed in 15 (14.4%) wrestlers. Across the entire cohort, survivorship rates free from recurrent instability and revision surgery were 90.4% and 92.5% at 2 years, 71.9% and 70.7% at 5 years, and 71.9% and 66.5% at 10 years, respectively. Preoperative recurrent instability was an independent risk factor for postoperative recurrent instability (hazard ratio, 3.8; 95% CI, 1.33-11.03; P = .012).

Conclusion: Competitive wrestlers with multiple dislocations before initial clinical evaluation were 3.8 times more likely to experience postoperative recurrent instability. Patients should be counseled that despite SIS, only 57.3% returned to wrestling after surgery.

Keywords: shoulder instability; anterior shoulder instability; posterior shoulder instability; multidirectional shoulder instability; wrestling; return to sport; Bankart repair; Latarjet

Competitive wrestling is a growing sport accounting for >2.5 million athletes worldwide.[19] Compared with other sports, wrestling frequently places athletes at a high risk of sustaining various musculoskeletal injuries.[17,18,21,23] In these young athletes, the downstream sequelae of injuries include recurrent extremity complications, time away from sport, surgery, and psychosocial challenges.[5] Notably, the shoulder girdle is often susceptible to injury as it is a frequent target for the application of supraphysiological forces with or without the presence of generalized ligamentous laxity.[22]

Previously, Pasque and Hewett[22] followed a prospective cohort of 458 wrestlers, noting the shoulder as the most common area of injury, and that the shoulder accounted for nearly 1 in 4 season-ending injuries.[22] At the collegiate

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level, wrestling has demonstrated an incidence of 22 shoulder and elbow injuries per 10,000 athlete-exposures.[11] More recent investigations build on these data, noting a high prevalence of upper extremity injuries, particularly shoulder instability (35.6 injuries per 100,000 athlete-exposures) and operative shoulder injuries (1.14 per 10,000 athlete-exposures).[9,22,32] Mechanistically, these injuries occur during competition, practice, and drilling and are most common during takedowns.[15,22]

In the general population, the incidence of shoulder dislocation is approximately 24 per 100,000 person-years, with young men being at a much higher risk.[8,36] Wrestling further serves as a predisposing factor because of the physically demanding nature of the sport and also the profile of the young competitors. In athletes, shoulder instability surgery (SIS) has become a common treatment option for those who sustain traumatic shoulder instability.[1,8,10,14] Current investigations regarding surgical treatment for shoulder instability are often focused on anterior shoulder instability (ASI) in the military population or athletes participating in mainstream sports.[1,8,10,14]

Subsequently, there are generally fewer studies evaluating the effect of SIS in wrestlers.[2,33] Furthermore, given the high rate of injuries and need for operative intervention, additional studies are needed to effectively counsel wrestlers who sustain shoulder instability.[34] Therefore, the purpose of this study was to assess reoperation rates, patient-reported outcomes, and return to wrestling (RTW) after SIS in a cohort of competitive wrestlers. Compared with previous literature reports, we hypothesized that this cohort of competitive wrestlers would have a $\geq$75% rate of return to sport (RTS) with a $<$20% rate of recurrent instability.

METHODS

After institutional review board approval from both the Mayo Clinic and the Olmstead Medical Center (16-007084 and 042-OMC-16), a retrospective search of an established geographic-based medical record system (Rochester Epidemiology Project) was performed. Patients were first identified using International Classification of Diseases, 9th Revision, diagnosis codes for shoulder instability events. A series of text-string searches using natural language processing was subsequently performed to identify patients who underwent SIS and those with a documented history of competitive wrestling before surgery (144 shoulders). Competitive wrestlers were defined as athletes who competed at various levels (club, high school, collegiate, or professional), including all common styles of wrestling (Greco-Roman, folk style, and freestyle). Professional wrestlers were defined as athletes receiving compensation. Club sport wrestlers were athletes who did not participate in a high school, collegiate, or professional team.

A manual review of the electronic medical record was then performed to obtain patient characteristics (age, sex, laterality, hand dominance, and body mass index) and injury characteristics (date, instability direction, concomitant injuries, and number of instability events). Traumatic instability was defined as an instability event directly associated with a trauma and not the sequelae of a habitual or voluntary dislocation. Hyperlaxity was diagnosed by the treating surgeon based on physical examination often using a combination of the sulcus sign, side-to-side difference $\geq$20° in hyperabduction, or external rotation $\geq$85° with the arm at the side.[3] Imaging findings from radiographs, magnetic resonance imaging (MRI), and computed tomography (CT) were also described if obtained. There were 9 shoulders without reviewable MRI or CT images with only reports and surgeon interpretation available. Recurrent instability was defined as patients who had multiple instability events (subluxation or dislocation). Surgical procedures were performed at a single academic institution. Glenoid and humeral head bone loss estimates were made by the treating surgeons based on the combination of preoperative advanced imaging and intraoperative assessments. Specific treatment was driven by a combination of the injury pattern, physical examination, radiographic characteristics, patient goals, and surgeon preference. Among the techniques, arthroscopic stabilization was the primary treatment modality. However, patients evaluated with recurrent instability were more likely to receive open stabilization, and those with glenoid bone loss were more likely to receive open bony augmentation. Postoperatively, patients were followed clinically as well as radiographically.

Included patients were wrestlers who underwent surgical treatment of shoulder instability between 1996 and 2020. Exclusions consisted of those with non–wrestling related injuries (n = 11), previous instability surgery to

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the affected shoulder (n = 9), incomplete medical records (n = 8), <2 years of clinical follow-up (n = 7), no available imaging (n = 4), and an acute axillary nerve injury with sustained motor deficits (n = 1). For this final group, additional data were collected from pre- and postoperative periods to obtain baseline characteristics and postsurgical outcomes. All directions of instability, ASI, posterior shoulder instability (PSI), and traumatic multidirectional shoulder instability (TMDI) were included and characterized based on surgeon documentation. Those with TMDI were patients with a history of a trauma resulting in shoulder instability in >1 direction and noted to not have hyperlaxity at the time of evaluation. For postoperative documentation, operative notes, most recent follow-up visits, electronic medical record correspondence, and telephone calls were used. Through this we assessed complications, recurrent instability, reoperations, RTS, RTW, and the Western Ontario Shoulder Instability Index score. For the RTS and RTW analysis, patients were excluded if they graduated during the same year of their SIS, making them ineligible to return. The date of return was recorded as the date of clearance by the orthopaedic surgeon. Return to competition was confirmed with patient charts and telephone calls.

Postoperative rehabilitation was dictated by the selected SIS and concomitant pathology. For the first 4 to 6 weeks, patients are typically placed in a shoulder sling with no active shoulder motion. Afterward, passive and active-assisted range of motion are initiated. Once functional range of motion is achieved, isometric strengthening with scapular stabilization is performed. At 12 weeks, weight-bearing through the shoulder and plyometric exercises are initiated. Sport-specific training is initiated at 5 months with a goal of unrestricted return to play by 6 months. Definitive clearance to sport and wrestling was determined by a combination of surgeon physical examination, symmetric upper extremity strength testing, adequate scapular muscular control, satisfactory performance on functional tests, and comfort with activities of sport.

Statistical Analysis

All data were analyzed using BlueSky software (BlueSky Statistics Inc). Descriptive statistics were used to describe patient characteristics with means, standard deviations, proportions, percentages, medians, and interquartile ranges, when appropriate. The Shapiro-Wilk test was used to assess distribution normality. Cohorts were compared using the chi-square or Fisher exact test for proportions and the *t* test or Mann-Whitney *U* test for nominal values. For continuous data comparisons involving all 3 groups, the analysis of variance and Kruskal-Wallis tests were used for parametric and nonparametric distributions, respectively. Survivorship free of recurrent instability and reoperation was independently assessed using a Kaplan-Meier analysis with significance determined by the log-rank test. A multivariable Cox proportional hazards regression analysis was also performed to assess the predictors of recurrent instability using previously described risk factors in the literature.[4,6,31] Statistical significance was acknowledged for all *P* values <.05.

RESULTS

The final cohort consisted of 104 wrestlers treated surgically for shoulder instability with a mean follow-up of 5.2 ± 5.1 years (range, 2.0-22.0 years). At the time of clinical presentation, 58 (55.8%) wrestlers had experienced only 1 shoulder instability event, while 46 (44.2%) had sustained multiple events before presentation. ASI was the most common direction (n = 79; 76.0%), followed by PSI (n = 14; 13.5%) and TMDI (n = 11; 10.6%). For the entire cohort, the mean age at initial instability was 16.9 ± 2.3 years (range, 12.0-22.7 years) and the mean age at surgery was 18.9 ± 3.2 years (range, 14.0-29.0 years). There were no significant demographic differences among the patients based on instability direction (Table 1).

Radiographically, 13 (12.5%) wrestlers had a humeral head impaction fracture (Hill-Sachs lesion) and 9 (8.7%) had a glenoid rim fracture (bony Bankart) at the time of radiographic evaluation (Table 2). MRI scans were obtained in 92 (88.5%) wrestlers, with anteroinferior labral tears as the most commonly visualized pathology (n = 62; 67.4%), followed by chondral injuries (n = 24; 26.1%) and superior labrum anterior and posterior tears (n = 23; 25%). CT scans were obtained in 19 (18.3%) wrestlers and glenoid bone loss was identified on advanced imaging in 18/95 (18.9%) wrestlers.

The most common surgical treatment performed was arthroscopic soft tissue stabilization (n = 88; 84.6%), followed by open soft tissue repair (n = 13; 12.5%) and open bony augmentation (n = 3; 2.9%). The anteroinferior labrum was most often addressed surgically (n = 62; 59.6%), followed by the posteroinferior (n = 29; 27.9%) and the posterosuperior (n = 27; 26.0%) labrum. Adjunct surgical procedures included 4 (3.8%) remplissage, 2 (1.9%) biceps tenodesis, and 5 (4.8%) rotator cuff debridements (Table 3).

Of the 85 eligible athletes, 72 (84.7%) returned to competitive sports. However, among the 75 eligible wrestlers, 43 (57.3%) returned to competitive wrestling at a mean of 9.8 months (Table 4). Clinical complications were observed in 21 (20.2%) wrestlers, with recurrent instability being the most common (n = 18; 17.3%). The remaining 3 complications were 1 (1%) traumatic acromioclavicular joint separation, 1 (1%) symptomatic loose anchor and chondrolysis, and 1 (1%) recurrent symptomatic labral tear without instability. Subsequent reoperations included 15 (14.4%) revision shoulder instability procedures and 1 (1%) acromioclavicular joint reconstruction. Among the 18 (18.9%) athletes with glenoid bone loss, 7 (38.9%) wrestlers sustained recurrent instability, 5 (27.8%) underwent revision SIS, and 9 (50%) were able to return to competitive wrestling at a mean of 91.8 months.

Kaplan-Meier survivorship analysis for the entire cohort indicated that the percentage of patients who were free from recurrent instability was 91.4% at 1 year, 90.4% at 2 years,

TABLE 1
Patient and Clinical Characteristics[a]

	Entire Cohort, N = 104	Anterior, n = 79	Posterior, n = 14	Traumatic Multidirectional, n = 11	*P*
Age, y					
At initial instability	16.9 ± 2.3	16.8 ± 2.3	17.1 ± 2.5	17.7 ± 2.2	.382
At surgery	18.9 ± 3.2	18.7 ± 3.1	19.4 ± 4.0	19.3 ± 2.9	.522
Sex					
Male	103 (99.0)	78 (98.7)	14 (100)	11 (100)	>.999
Female	1 (1.0)	1 (1.3)	0 (0)	0 (0)	
Body mass index	25.4 ± 4.5	25.5 ± 4.9	24.4 ± 2.5	26.1 ± 3.9	.550
Level of competition					.175
High school	79 (76.0)	62 (78.5)	10 (71.4)	7 (63.6)	
Collegiate	20 (19.2)	15 (19.0)	3 (21.4)	2 (18.2)	
Club	4 (3.8)	1 (1.3)	1 (7.1)	2 (18.2)	
Professional	1 (1.0)	1 (1.3)	0 (0)	0 (0)	
Laterality					>.999
Left	44 (42.3)	33 (41.8)	6 (42.9)	5 (45.5)	
Right	60 (57.7)	46 (58.2)	8 (57.1)	6 (54.5)	
Instability events					.447
First time	58 (55.8)	42 (53.2)	8 (57.1)	8 (72.7)	
Recurrent	46 (44.2)	37 (46.8)	6 (42.9)	3 (27.3)	
Follow-up, y, mean ± SD (range)	5.2 ± 5.1 (2.0-22.0)	5.3 ± 5.1 (2.0-20.3)	3.0 ± 0.9 (2.0-4.8)	7.2 ± 7.2 (2.2-22.0)	.478

[a]Values are presented as mean ± SD or n (%) unless otherwise indicated.

TABLE 2
Imaging Characteristics[a]

	Entire Cohort, N = 104	Anterior, n = 79	Posterior, n = 14	Traumatic Multidirectional, n = 11	*P*
Radiographs					
Humeral head impaction fracture	13 (12.5)	12 (15.2)	0 (0)	1 (9.1)	.355
Glenoid rim fracture	9 (8.7)	8 (10.1)	0 (0)	1 (9.1)	.664
MRI[b]					
Anteroinferior labral tear	62 (67.4)	55 (79.7)	0 (0)	6 (60.0)	**<.001**
Glenoid rim fracture	15 (16.3)	15 (21.7)	0 (0)	0 (0)	.057
SLAP tear	23 (25.0)	18 (26.1)	2 (15.4)	3 (30.0)	.664
Posterosuperior labral tear	17 (18.5)	9 (13.0)	5 (38.5)	3 (30.0)	.054
Posteroinferior labral tear	17 (18.5)	8 (11.6)	8 (61.5)	1 (10.0)	**<.001**
Glenohumeral ligament tear	13 (14.1)	13 (18.8)	0 (0)	0 (0)	.103
HAGL	3 (3.3)	3 (4.3)	0 (0)	0 (0)	>.999
Biceps tendon pathology	7 (7.6)	4 (5.8)	1 (7.7)	2 (20.0)	.218
Chondral injury	24 (26.1)	20 (29.0)	3 (23.1)	1 (10.0)	.530
Paralabral cyst	5 (5.4)	3 (4.3)	0 (0)	2 (20.0)	.146
Rotator cuff injury	13 (14.1)	8 (11.6)	2 (15.4)	3 (30.0)	.202
Glenoid bone loss[c]	18 (18.9)	18 (25.0)	0 (0)	0 (0)	**.026**

[a]Values are presented as n (%). Bold values represent statistical significance ($P < .05$). HAGL, humeral avulsion of the glenohumeral ligament; MRI, magnetic resonance imaging; SLAP, superior labrum anterior and posterior.

[b]MRI scans were performed for 92 shoulders in the entire cohort: 69 in the anterior group, 13 in the posterior group, and 10 in the multidirectional group.

[c]Evaluation of bone loss included both MRI and computed tomography scans 4.

71.9% at 5 years, and 71.9% at 10 years (Figure 1). Specific comparison by instability direction (ASI, PSI, and TMDI) demonstrated similar rates of 89.9% versus 100% versus 100% at 1 year, 87.3% versus 100% versus 100% at 2 years, 70.1% versus 100% versus 60% at 5 years, and 70.1% versus 60% at 10 years, respectively ($P = .214$). Of note, the PSI cohort did not have 10-year survivorship data available.

Survivorship analysis free of revision SIS was 98.1% at 1 year, 92.5% at 2 years, 70.7% at 5 years, and 66.5% at 10 years (Figure 2). Specific comparison by instability

TABLE 3
Surgical Treatment Strategies[a]

	Entire Cohort, N = 104	Anterior, n = 79	Posterior, n = 14	Traumatic Multidirectional, n = 11	*P*
Type of surgery					.430
Arthroscopic	88 (84.6)	64 (81.0)	14 (100)	10 (90.9)	
Open with soft tissue repair	13 (12.5)	12 (15.2)	0 (0)	1 (9.1)	
Open with bony augmentation	3 (2.9)	3 (3.8)	0 (0)	0 (0)	
Specific pathology addressed[b]					
Anteroinferior labral tear	62 (59.6)	56 (70.9)	0 (0)	6 (54.5)	**<.001**
Anterosuperior labral tear	19 (18.3)	16 (20.3)	0 (0)	3 (27.3)	.156
Posterosuperior labral tear	27 (26.0)	18 (22.8)	6 (42.9)	3 (27.3)	.344
Posteroinferior labral tear	29 (27.9)	12 (15.2)	14 (100)	3 (27.3)	**<.001**
Adjunct surgical procedures					
Remplissage	4 (3.8)	4 (5.1)	0 (0)	0 (0)	>.999
Biceps tenodesis	2 (1.9)	1 (1.3)	1 (7.1)	0 (0)	.136
Rotator cuff debridement	5 (4.8)	3 (3.8)	0 (0)	2 (18.2)	.118

[a]Values are presented as n (%). Bold values represent statistical significance ($P < .05$).

TABLE 4
Clinical and Patient-Reported Outcomes[a]

	Entire Cohort, N = 104	Anterior, n = 79	Posterior, n = 14	Traumatic Multidirectional, n = 11	*P*
Clinical outcomes					
Complications	21 (20.2)	19 (24.1)	0 (0)	2 (18.2)	.082
Recurrent instability	18 (17.3)	16 (20.3)	0 (0)	2 (18.2)	.180
Reoperation	16 (15.4)	14 (17.7)	0 (0)	2 (18.2)	.207
Revision surgery	15 (14.4)	13 (16.5)	0 (0)	2 (18.2)	.199
Arthroscopic	6 (5.8)	5 (6.3)	0 (0)	1 (9.1)	
Open with soft tissue repair	7 (6.7)	7 (8.9)	0 (0)	0 (0)	
Open with bony augmentation	2 (1.9)	1 (1.3)	0 (0)	1 (9.1)	
Patient-reported outcomes					
Return to competitive sports[b]	72 (84.7)	55 (84.6)	9 (81.8)	8 (88.9)	.908
RTW[c]	43 (57.3)	32 (57.1)	6 (54.5)	5 (62.5)	.940
RTW at the previous level[c]	41 (54.7)	31 (55.4)	5 (45.5)	5 (62.5)	.992
Time to return to play, mo	9.8 ± 9.6	9.8 ± 9.5	10.0 ± 4.2	9.9 ± 8.9	.831
Satisfied with shoulder surgery	85 (81.7)	68 (86.1)	10 (71.4)	7 (63.6)	.347
WOSI score[d]	466.9 ± 497.4	364.8 ± 338.4	772.0 ± 783.8	842.3 ± 966.8	.501

[a]Values are presented as n (%) or mean ± SD. RTW, return to wrestling; WOSI, Western Ontario Shoulder Instability Index.
[b]A total of 85 patients were eligible for return-to-sport analysis.
[c]A total of 75 patients were eligible for RTW analysis.
[d]A total of 70 patients had patient-reported outcome scores available.

direction (ASI, PSI, and TMDI) demonstrated similar rates of 97.5% versus 100% versus 100% at 1 year, 93.7% versus 100% versus 100% at 2 years, 72.8% versus 100% versus 60% at 5 years, and 64.1% versus 60% at 10 years, respectively ($P = .360$). Of note, the PSI cohort did not have sufficient 10-year survivorship data available for subgroup analysis.

A subanalysis was performed comparing patients with postoperative recurrent instability (n = 18) with those with stable shoulders (n = 86). The presence of multiple instability events at the time of initial presentation was the only factor associated with a higher rate of postoperative recurrent instability (66.7% vs 40.7%; $P = .044$). Age at time of surgery demonstrated a numerical trend (16.6 vs 19.1; $P = .94$). A multivariable Cox proportional hazards analysis confirmed that preoperative recurrent instability was an independent risk factor for postoperative recurrent shoulder instability (hazard ratio, 3.8; 95% CI, 1.33-11.03; $P = .012$) (Table 5).

DISCUSSION

The primary finding of this study was that SIS led to favorable outcomes within the first 2 years; however, over time there were 71.9% and 66.5% survivorship free rates from

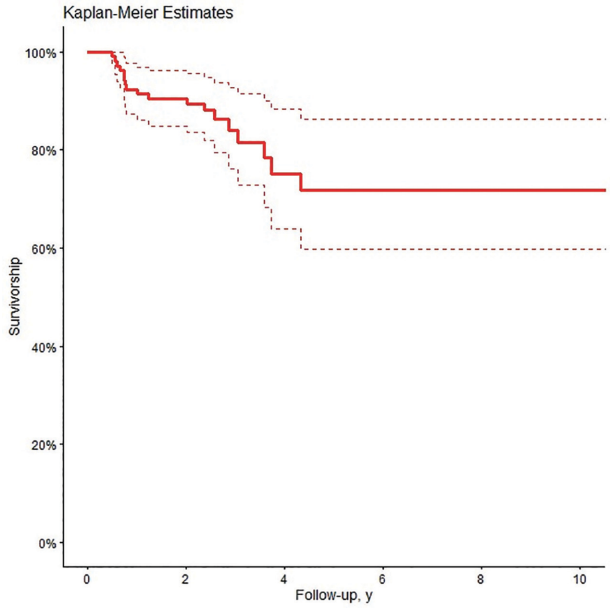

Figure 1. Kaplan-Meier survivorship curve demonstrating progression to recurrent instability. Dotted lines represent 95% confidence interval.

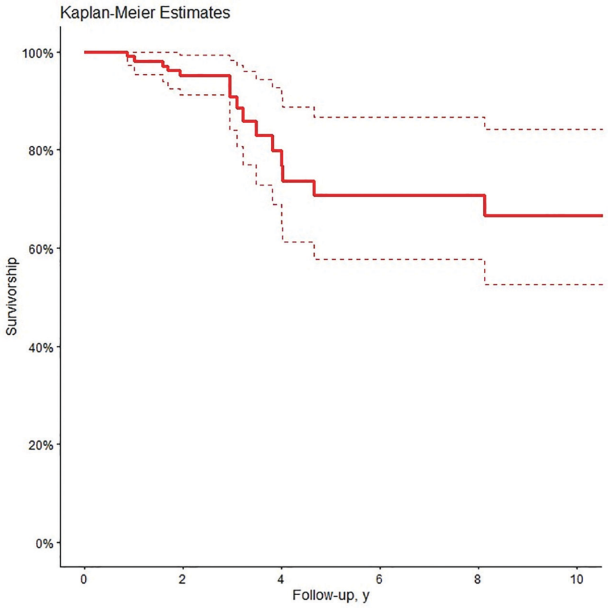

Figure 2. Kaplan-Meier survivorship curve demonstrating progression to revision shoulder instability surgery. Dotted lines represent 95% confidence interval.

recurrent instability and revision SIS, respectively, at 10 years. Furthermore, wrestlers with multiple dislocations before initial clinical presentation were 3.8 times more likely to experience postoperative recurrent instability, even when accounting for possible confounding variables such as age, type of surgery, and glenoid bone loss on advanced imaging.

Shoulder stability is especially important for high-level athletes, including competitive wrestlers who require smooth, stable tracking throughout the full shoulder range of motion and strength when engaging in contact.[1,2,26] However, this young athletic cohort remains at risk for recurrence despite treatment. With respect to ASI, Ranalletta et al[27] followed a cohort of 56 athletes (22 contact and 34 collision) after arthroscopic shoulder stabilization and observed a 14.7% rate of recurrent shoulder instability in the collision sport group (eg, rugby, boxing, ice hockey, American football, and wrestling) compared with 0% in the contact sport cohort (eg, soccer and field hockey). This elevated risk in collision athletes after arthroscopic stabilization has also been observed in the adolescent population, where Nixon et al[20] demonstrated a 31% recurrence rate at 4 years in a cohort of primarily adolescent rugby players.

More recently, Rossi et al[28] demonstrated the importance of long-term follow-up in athletes at risk for recurrent instability. Specifically, they followed a cohort of 272 athletes with ASI and subsequent arthroscopic Bankart repair, demonstrating a 5% recurrence rate at 2 years of follow-up, which increased to 25% at 10 years. Furthermore, in their cohort of contact and collision athletes, these rates were 15% at 2 years and increased to 25% by 8 years. These findings are consistent with the current investigation of contact athletes, which demonstrated 2-year rate of recurrent instability and revision rates of 9.6% and 7.5%, which increased to 28.1% and 33.5% at 10 years. Moreover, when focusing on ASI alone, the 2-year rates of recurrent instability and revision rates were 12.7% and 6.3%, which increased to 29.9% and 35.9% at 10 years, respectively.

These findings represent relevant discussion points to consider when counseling patients on expectations after surgery in both the short and the long term. This must include management of patient expectations after the first shoulder instability event. In the present study, preoperative recurrent instability led to a 3.8-times increased risk for postoperative recurrent instability, even when

TABLE 5
Multivariable Cox Proportional Hazards Analysis for Recurrent Instability[a]

	Recurrent Instability	
Variable	Hazard Ratio (95% CI)	*P*
Age, per 1-y increment	0.90 (0.72-1.13)	.374
Type of surgery		
Arthroscopic	1.00 (reference)	
Open	0.57 (0.13-2.55)	.462
Glenoid bone loss on advanced imaging[b]	2.86 (0.91-8.95)	.071
Instability events		
First time	1.00 (reference)	
Recurrent	3.8 (1.33-11.03)	**.012**[a]

[a]Bold values represent statistical significance ($P < .05$).
[b]Advanced imaging represents a magnetic resonance imaging or computed tomography scan.

controlling for age, type of surgery, and glenoid bone loss. Similar findings have been outlined in the literature, with Duethman et al[6] observing multiple instability events as a major predictor of failure in the nonoperative treatment of ASI. These findings should be considered during patient counseling, as these healthy young athletes often have very high expectations regarding their shoulder after surgery and the ability to RTS.[24]

In the present study, although 84.7% of athletes were able to return to competitive sports, only 57.3% were able to return to competitive wrestling at a mean of 9.8 months. Once again, when focusing on ASI, the RTS rate was 84.6% and the RTW rate was 57.1%. In reviewing the literature, estimated rates of RTS after ASI range from 63% to 92%, depending on the type of sport, often with contact or overhead athletes having lower rates of return.[1,12,28,35] These findings highlight the elevated demands of the athlete's shoulder during competition. Possible explanations for our group of wrestlers being unable to RTW specifically likely stem from the difficulty of surgical stabilization to restore the same level of function and native stability that was able to withstand the demands of the sport. This may also be influenced by the fact that a relatively low percentage of high school–aged wrestlers go on to compete at the collegiate level, even across healthy athletes.

PSI and multidirectional instability represent less frequent occurrences of shoulder instability with an emerging body of literature regarding outcomes. In a systematic review of 25 studies and 895 shoulders,[7] return to play ranged from 62.7% to 100% occurring between 4.3 and 8.6 months. Furthermore, in collision athletes this high rate of RTS was maintained at 80% to 100%, but with a lower rate of return to the same level of play, at 69.2% to 100%.[7] More recently, Rothrauff et al[29] published a study on the long-term clinical outcomes of shoulder function after arthroscopic posterior shoulder stabilization at a minimum 10-year follow-up. In their cohort of 55 shoulders, 60% returned to sport, 35% sustained treatment failure, and 13% underwent revision surgery. These findings are similar to our PSI cohort, which demonstrated a 54.5% RTW rate, highlighting a potential area that may warrant further sport-specific investigation.

In the literature, multidirectional shoulder instability (MDI) often refers to shoulders with generalized laxity and developed adaptations that lead to pathologic dysfunction.[1] Therefore, surgical management of MDI is often individualized to address the anatomic cause of instability.[1,16] In our cohort of wrestlers, we describe TMDI in patients who were not hyperlax at baseline. Therefore, the findings of the current study that focused on traumatic instability may not be comparable with the traditional literature for MDI due to hyperlaxity.

This study has several notable limitations. First, this was a retrospective nonrandomized investigation that allowed for indication and selection bias. This is especially important as the investigation included 6 surgeons (J.D.B., A.J.K., and C.L.C.) and spanned multiple decades. Therefore, management of these patients was heavily influenced by individual surgeon preference and evolving best practices over the course of the study period. This may have led to interpretive bias of clinical and radiographic findings that ultimately resulted in different operative management strategies and rehabilitative approaches.

Second, the presented data were limited by the lack of standardized imaging over time and the amount of detail documented within the electronic medical record. This led to an inability to precisely quantify the specific amount of glenoid bone loss, number of surgical anchors, glenoid anchor location, and rehabilitation protocols. This is especially important as glenoid bone loss is a well-established risk factor for recurrent shoulder instability and a key determining factor when considering adjunct procedures.[25] Traditionally, 20% to 25% bone loss has been published as the critical cutoff value at which glenoid bone loss warrants reconstruction during surgery. However, there is a growing body of evidence demonstrating that in some at-risk subgroups, which mainly include collision or contact athletes, or in those who failed previous arthroscopic stabilization, lower bone loss deficit thresholds (13.5%-20%) should be considered to prevent suboptimal results.[13,30]

Third, this study retrospectively generated a small sample size, which led to the decision to include all directions of shoulder instability to optimize the study sample size. Subgroup analyses may have been underpowered at times, especially in the context of rare frequency events (ie, complications, reoperations, and RTS). This may have also influenced the multivariable Cox proportional hazards analysis, and specifically the influence of glenoid bone loss as a risk factor for recurrent instability. Fourth, data regarding RTS and patient-reported outcomes were collected in the chart if documented at the time. However, there were occasions where these data were collected and updated at the telephone follow-up, in which patients were subject to participation and recall bias.

Future investigations should build on the present work to include larger cohorts with increased detail regarding preoperative imaging and surgical characteristics to better determine the relationship of glenoid bone loss to rate of recurrent instability. Moreover, future studies should be performed to identify the role of when to consider adjunct procedures such as remplissage or bony augmentation when evaluating these high-risk athletes.

CONCLUSION

Competitive wrestlers with multiple dislocations before initial clinical presentation were 3.8 times more likely to experience postoperative recurrent instability. Patients should be counseled that despite SIS, only 57.3% returned to wrestling after surgery.

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