High Prevalence of Superior Labral Anterior-Posterior Tears Associated With Acute Acromioclavicular Joint Separation of All Injury Grades

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Background: Despite the relatively high number of cases of acromioclavicular joint (AC) separation in the athletic population, optimal clinical outcomes are not achieved in every case. Limited data exist regarding the prevalence of intra-articular glenohumeral pathologies (IAPs) associated with acute AC separation of all injury grades.

Purpose: To determine the prevalence of IAPs associated with AC separation, regardless of severity.

Study Design: Case series; Level of evidence, 4.

Methods: A total of 62 patients (mean age, 37.6 years) with acute AC separation were included in this study; 41 were nonoverhead recreational athletes. All patients underwent magnetic resonance arthrography (MRA) to evaluate for IAPs. Arthroscopic data from patients undergoing surgical treatment were correlated with MRA results.

Results: Patients sustained acute AC separation of Rockwood grade 1 (16.1%), grade 2 (46.8%), grade 3 (25.8%), and grade 4 (11.3%). A concomitant IAP was present in 48 of 62 (77.4%) patients and included superior labral anterior-posterior tears (72.6%), anterior labral tears (24.2%), posterior labral tears (4.8%), supraspinatus tears (3.2%), and inferior glenohumeral ligament ruptures (1.6%). There were 18 (29.0%) patients who had a concomitant pathology in >1 intra-articular structure (combined IAPs). Additionally, 71.8% of patients with grade 1 and 2 AC separation had associated IAPs, and 23.1% had combined IAPs. Furthermore, in patients younger than 40 years, 64.0% of those with grade 1 to 3 AC separation demonstrated associated labral pathologies. There was no difference when comparing age or severity of AC separation and the prevalence of concomitant labral tears ($P = .36$ and .22, respectively).

Conclusion: There was a high prevalence of IAPs among patients undergoing MRA after AC separation. While an IAP has been described in association with high-grade AC separation previously, the high prevalence of IAPs in low-grade separation in our study was unexpected and suggests that a thorough evaluation and clinical follow-up for patients with all grades of AC separation may be beneficial.

Keywords: shoulder; acromioclavicular joint separation; labral tear; intra-articular pathology

Acromioclavicular joint (AC) separation is a frequently observed injury in the athletic population and has been described in as high as 40% to 50% of athletically related shoulder injuries.[15,18,36] An increasing number of surgical case series have documented concomitant intra-articular glenohumeral pathologies (IAPs) based on a diagnostic arthroscopic examination accompanying the surgical treatment of AC dislocations.[2,12,22,23,37] Pauly et al[23] reported a prevalence of 30.4% for IAPs in patients undergoing arthroscopically assisted surgical treatment after sustaining Rockwood grade 3 to 5 AC separation; all concurrent

pathologies identified in their study underwent a surgical intervention. Arrigoni et al[2] found that 42.8% of study participants were diagnosed with at least 1 additional pathological lesion in a series of 98 patients undergoing surgical treatment for grade 3 AC dislocations, with nearly 70% identified as a significant associated lesion that required dedicated surgical treatment. There were 2 separate studies that noted that the majority of these associated IAPs were labral tears.[12,37] Further demonstrating its clinical relevance, Jensen et al[12] reported that 45 patients (12.0%) in their surgical series had ≥1 IAP that required an additional repair/reconstructive procedure.

While knowledge of associated pathologies is certainly important for patients undergoing surgical treatment for AC separation, understanding the entire spectrum of

injury is equally important to optimize the management of patients treated nonoperatively after AC separation. Illustrating this point, Petri et al[25] reported that 8 of 12 patients who failed nonoperative management of grade 3 AC separation had concomitant glenohumeral pathologies at the time of eventual operative management. The available studies describe only the rate of concomitant pathologies reported in surgical cases involving higher grade AC separation. Concomitant pathologies have traditionally been assumed to be less common in lower grades of AC injuries.[37] Despite the relatively high number of cases of AC separation in the athletic population, an optimal clinical outcome is not achieved in every case.[10,18] There are multiple reasons for this finding, but a prevailing notion is that an undetected glenohumeral pathology is a factor.[23]

A better understanding of the prevalence of associated lesions in acute AC injuries may present a first step toward improved management of these common injuries. A clinical examination of acute AC separation may be limited because the significant pain on initial presentation limits an acute examination.[23] Labral pathologies and superior labral anterior-posterior (SLAP) tears are often difficult to diagnose by a clinical examination, as symptoms are often difficult to distinguish from symptoms of AC pathologies.[6,13] Multiple authors have suggested using magnetic resonance arthrography (MRA) to evaluate IAPs with AC separation, especially labral tears.[23,37] The goal of this study was to determine the prevalence of IAPs in all grades of acute AC separation using MRA and/or arthroscopic surgery. The hypothesis was that an IAP is frequently present in all grades of AC separation.

METHODS

Between 2007 and 2017, a total of 73 consecutive patients were clinically diagnosed with an acute AC injury by a single orthopaedic surgeon (K.M.) and prospectively followed in this institutional review board–approved study. No funding was provided. A descriptive retrospective review of prospectively collected data was completed. Inclusion criteria were patients clinically diagnosed with an AC injury but without evidence of prior pain or trauma in the affected shoulder. Based on previous research demonstrating increased degenerative changes in the shoulders of patients older than 60 years,[26] patients aged ≥60 years were excluded from the analysis to reduce any age-related bias effects. Overall, 62 patients met the inclusion/exclusion

criteria. There were 44 patients who were recreational athletes compared with 18 nonathletes. Of note, only 3 were overhead athletes (baseball), only 1 had a history of shoulder surgery, and none reported shoulder pain before their injury.

Each patient's AC separation was diagnosed radiographically (anteroposterior, scapular Y, axillary). Bilateral AC Zanca views were obtained to look at the coracoclavicular distance of both shoulders for comparison and diagnosis. The AC injuries were classified according to the Rockwood classification by a musculoskeletal radiologist and independently confirmed by the senior author (K.M.). The evaluation for associated glenohumeral joint pathologies included clinical and radiographic examinations. All patients with an acute AC injury were evaluated for associated shoulder pathologies using MRA.[34] The MRA was performed by an independent musculoskeletal radiologist, and SLAP lesions were graded based on MRA findings using the Snyder classification (Figure 1).[33] A standardized protocol was used for MRA, including a phased-array coil, a 1.5-T magnet, and a slice thickness of 3.5 mm. Pulse sequences included the following: axial T1, axial proton density (PD) fat saturation (FS), sagittal oblique PD FS, coronal oblique T1 FS, coronal oblique T2 FS, and abduction external rotation T1 FS.

Nonoperative management consisting of physical therapy and/or injections was attempted for at least 10 weeks in the majority of patients (58.1%). Operative management was undertaken through a shared decision-making process with the patient, and 26 of 62 patients (41.9%) underwent surgical treatment based on either severity of the AC injury, significant associated intra-articular injuries (symptoms of instability, mechanical complaints, or persistent pain), or persistent shoulder symptoms unresponsive to nonoperative treatment. Intraoperatively, with the patient in the beach-chair position, the glenohumeral joint was evaluated arthroscopically by the senior author via a standard posterior portal. All IAPs were recorded and treated as necessary. SLAP tears were further classified according to the Snyder classification and were correlated with MRA findings.[32,33]

We performed a subset analysis of patients with versus without concomitant labral tears, with variables categorized as follows. AC separation was dichotomized by injury severity into low grade (Rockwood grades 1 and 2) versus high grade (Rockwood grades 3 and 4) and by age into younger (16-44 years) versus older (45-59 years). Age 45 years was chosen as the cutoff for the age comparison primarily
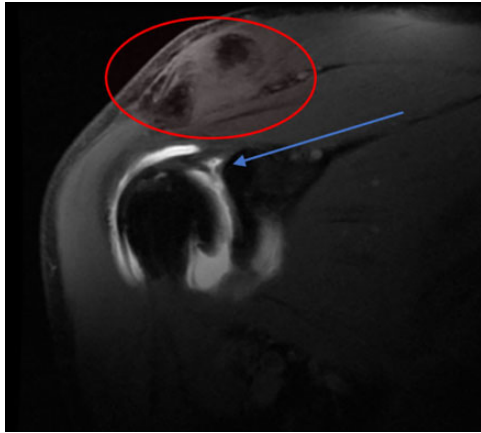
Figure 1. Magnetic resonance arthrography showing a concomitant intra-articular type 2 superior labral anterior-posterior tear (blue arrow) in a patient who sustained acute grade 2 acromioclavicular joint separation (red circle).

for consistency with prior literature.[2,12] Comparisons were made between (1) AC injury severity and presence/absence of concomitant labral tears and (2) age group and presence/absence of concomitant labral tears. Furthermore, the accuracy of MRA performed in this study was calculated using arthroscopic findings from the 26 patients who underwent surgical management.

With regard to a case-control comparison, multiple historical controls were selected. In an effort to identify a subset of patients that may have had pre-existing labral pathologies, an age-matched control group of patients with nontraumatic shoulder complaints referred for an assessment of rotator cuff tears was selected.[28] In an effort to compare the prevalence of labral pathologies in the study patients versus patients who may have sustained labral tears from trauma without an associated AC injury, an age-matched cohort with shoulder pain of a traumatic cause was selected. Specifically, historical controls of recreational athletes and nonathletes with shoulder trauma and/or dislocations were selected.[8] In an effort to compare the prevalence of labral pathologies in the study patients versus asymptomatic patients of the general population, a historical cohort of healthy asymptomatic volunteers aged 25 to 55 years was selected.[4] Similarly, in an effort to compare the prevalence of labral pathologies in the study patients versus asymptomatic athletes, a cohort of asymptomatic triathletes was selected.[27]

Statistical Analysis

All statistical analyses were performed using SigmaXL version 8.0 (SigmaXL). All variables were evaluated for the distribution of normality using a combination of histograms, quantile-quantile plots, and Shapiro-Wilk tests. Descriptive statistics were summarized as means and standard deviations for normally distributed quantitative variables, medians and interquartile ranges for nonnormally distributed quantitative variables, and counts and frequencies for categorical variables. Comparisons between independent groups were performed using the Kruskal-Wallis H test with the post hoc Mann-Whitney U test for nonnormally distributed quantitative variables and cross-tabulation with chi-square analysis for categorical variables. The accuracy of MRA with 95% CIs was calculated. P values were set to .05 for statistical significance.

RESULTS

Of the 62 patients included in the study, 52 (83.9%) were male with a mean age of 37.6 years (range, 16–59 years). The most common mechanism of injury was nonathletic trauma (36.7%; fall [23.8%] and motor vehicle accident [12.9%]), followed by biking (14.5%) and football (12.9%). The remaining 35.9% of patients suffered from a variety of mechanisms (skiing, baseball, aikido, hockey, rollerblading, rugby, wrestling, windsurfing, snowboarding, skateboarding, and soccer). There were 44 recreational athletes (3 overhead). The severity of AC injury ranged from 16.1% of patients with Rockwood grade 1 (10/62), 46.8% with grade 2 (29/62), 25.8% with grade 3 (16/62), and 11.3% with grade 4 (7/62).

MRA demonstrated associated IAPs in 44 of 62 (71.0%) patients at all grades of AC separation. In addition, 4 patients (3 had high-grade AC separation) had no associated pathology reported on MRA but underwent subsequent arthroscopic surgery, which identified associated shoulder pathologies. Thus, the overall prevalence of concomitant IAPs in our study was 48 of 62 (77.4%) patients. Of the 26 patients who underwent arthroscopic surgery, 22 patients had preoperative MRA demonstrating a concomitant glenohumeral joint injury that was confirmed with arthroscopic findings. Thus, the accuracy of MRA in predicting the prevalence of concomitant labral pathologies in our study was 84.6% (95% CI, 65.13%-95.64%). The most common concomitant injury was a SLAP tear, which was present in 45 patients (72.6%), followed by anterior labral tears in 15 (24.2%), posterior labral tears in 3 (4.8%), supraspinatus tears in 2 (3.2%), and inferior glenohumeral ligament (IGHL) ruptures in 1 (1.6%).

The subset analysis showed concomitant pathologies in >1 intra-articular structure (combined IAPs) in 18 of 62 (29.0%) patients: 2 of 10 (20.0%) with grade 1, 7 of 29 (24.1%) with grade 2, 5 of 16 (31.3%) with grade 3, and 4 of 7 (57.1%) with grade 4 AC separation. The subset analysis also showed that labral tears were present in 6 of 10 (60.0%) with grade 1, 22 of 29 (75.9%) with grade 2, 13 of 16 (81.3%) with grade 3, and 7 of 7 (100.0%) with grade 4 AC separation (Figure 2). Of the concomitant SLAP tears, 31.1% (14/45) were type 1 tears, 66.7% (30/45) were type 2 tears, and 2.2% (1/45) were type 3 tears (Figure 3). Regarding the type 1 SLAP tears, 5 of the 14 presented with concomitant anterior labral tears (2/14), posterior labral tears (2/14), or supraspinatus tears (1/14). Specifically, SLAP tears presented with concomitant anterior labral tears
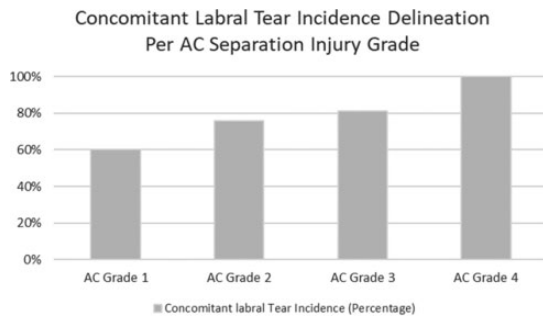
Concomitant Labral Tear Incidence Delineation
Per AC Separation Injury Grade

Figure 2. Bar graph depicting the prevalence of concomitant labral tears by acromioclavicular joint (AC) injury severity. As the severity of AC separation increased, there was an increased prevalence of labral tears overall as well as tears with a combined concomitant intra-articular pathology.
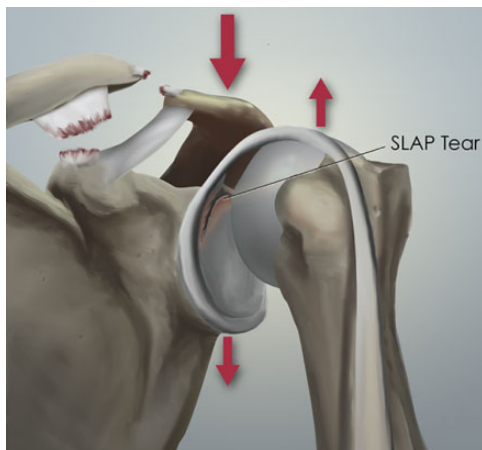

Figure 3. Representation of the suggested mechanism in which the significant forces required for acromioclavicular joint separation may be associated with a superior labral anterior-posterior (SLAP) tear. The impact of force on the acromion drives down the scapula and glenoid. This is in contrast to the relative upward movement of the humeral head, which in turn catches the biceps anchor, causing tearing of the superior labrum.

(13/18; 72.2%), posterior labral tears (2/18; 11.1%), supraspinatus tears (2/18; 11.1%), and IGHL ruptures (1/18; 5.6%).

Of the 39 patients with Rockwood grade 1 and 2 AC separation, 28 (71.8%) demonstrated concomitant IAPs. Specifically, there were 7 patients with combined labral tears, 17 with isolated SLAP tears (17.9% [7/39] were type 1 tears, 23.1% [9/39] were type 2 tears, and 2.6% [1/39] were type 3 tears), 1 with an isolated anterior labral tear, 1 with an isolated posterior labral tear, 1 with a SLAP 2 tear combined with an IGHL rupture, and 1 with a SLAP 2 tear combined with a supraspinatus tear. Of note, 9 patients presented with >1 associated pathology (23.1%). Furthermore, when expanded to grade 3, there were 41 of 55 (74.5%) who demonstrated concomitant IAPs.

TABLE 1
Prevalence of Concomitant Labral Tears
by AC Injury Severity and Age[a]

	Concomitant Labral Tear	No Concomitant Labral Tear	Total	P
AC injury severity, Rockwood grade				.22
Grades 1 and 2	28	11	39	
Grades 3 and 4	20	3	23	
Patient age				.36
Younger (16-44 y)	26	10	36	
Older (45-59 y)	22	4	26	

[a]Data are reported as No. Statistical significance set at $P < .05$. AC, acromioclavicular joint.

In patients younger than 40 years, 67.8% (19/28) demonstrated labral pathologies. The majority of this subset of patients were recreational athletes (20/28; 1 overhead athlete). Furthermore, 64.0% (16/25) of patients with grade 1 to 3 AC separation in this subset demonstrated associated labral pathologies. When comparing patients with and without concomitant labral tears, there was no significant difference with regard to mean age or sex ($P = .07$ and .16, respectively). The Fisher exact test revealed no significant differences in the prevalence of concomitant labral tears between high- or low-grade AC separation ($P = .22$). Also, there were no significant differences between younger (16-44 years) or older (45-59 years) patients and the prevalence of concomitant labral tears ($P = .36$) (Table 1).

Overall, 26 patients (41.9%) underwent operative management, which was indicated based on persistent shoulder symptoms unresponsive to nonoperative treatment (17.7% [11/62]), significant associated intra-articular injuries (9.7% [6/62]), or severity of the AC injury (14.5% [9/62]). Of the 39 patients with grade 1 and 2 AC separation, 14 (35.9%) underwent an operative intervention at a mean of 252 days after MRA. Regarding these patients, 20.5% (8/39) were indicated for surgical management based on persistent shoulder symptoms unresponsive to nonoperative treatment and 15.4% (6/39) were indicated with significant associated IAPs (Table 2). This is contrasted with 52.2% (12/23) of patients with grade 3 and 4 AC separation who underwent an operative intervention. Patients with grade 3 and 4 AC separation were 1.45 times more likely to require surgery than those with grades 1 and 2; however, this did not reach statistical significance ($P = .43$). Additionally, operative management was more frequent in patients with concomitant labral tears than those without (54.2% vs 0.0%, respectively; $P < .001$).

With regard to an age-matched historical control group of patients with nontraumatic shoulder complaints, in a study of 89 patients younger than 40 years who were referred for an assessment of rotator cuff tears, MRA revealed that only 19.1% (17/89) of patients showed an unsuspected labral tear.[28] This compares with 67.8% (19/28) of patients younger than 40 years demonstrating labral pathologies in the

TABLE 2
Operative Management and Indications of Rockwood Grade 1-3 AC Separation[a]

Age and Sex	Mechanism of Injury	AC Injury Grade	MRA Diagnosis	Indication	Arthroscopic Findings	Procedure
17 y, female	Baseball	1	SLAP 2 tear	Persistent shoulder symptoms unresponsive to nonoperative treatment: mechanical symptoms	SLAP 2 tear	SLAP repair
28 y, male	Skateboarding	1	Irregular anterior labrum	Persistent shoulder symptoms unresponsive to nonoperative treatment: instability	Anterior labral tear	Bankart repair
26 y, female	MVA	2	SLAP 1 tear	Persistent shoulder symptoms unresponsive to nonoperative treatment: persistent pain	SLAP 1 tear	SLAP debridement
29 y, male	MVA	2	SLAP 2 tear	Significant associated intra-articular injury: persistent pain	SLAP 2 tear	SLAP repair
51 y, female	Biking	2	SLAP 1 tear	Persistent shoulder symptoms unresponsive to nonoperative treatment: mechanical symptoms	SLAP 2 tear	SLAP repair
18 y, male	Football	2	SLAP 3 tear	Significant associated intra-articular injury: mechanical symptoms	SLAP 3 tear	SLAP debridement
46 y, female	Biking	2	SLAP 2 tear	Significant associated intra-articular injury: persistent pain	SLAP 2 tear	SLAP repair
47 y, male	Fall	2	No labral pathology	Persistent shoulder symptoms unresponsive to nonoperative treatment: mechanical symptoms	SLAP 2 tear	SLAP repair
44 y, male	Fall	2	Anterior labral tear and SLAP 2 tear	Significant associated intra-articular injury: instability	Anterior labral tear and SLAP 2 tear	SLAP repair and Bankart repair
52 y, male	Soccer	2	Anterior labral tear and SLAP 2 tear	Persistent shoulder symptoms unresponsive to nonoperative treatment: mechanical symptoms and persistent pain	Anterior labral tear and SLAP 2 tear	SLAP repair and Bankart repair
59 y, male	Biking	2	Anterior labral tear and SLAP 2 tear	Persistent shoulder symptoms unresponsive to nonoperative treatment: mechanical symptoms and persistent pain	Anterior labral tear and SLAP 2 tear	SLAP repair and Bankart repair
19 y, male	Football	2	Anterior labral tear and SLAP 1 tear	Significant associated intra-articular injury: instability	Anterior labral tear and SLAP 1 tear	SLAP debridement and Bankart repair
42 y, male	Hockey	2	Rotator cuff tear and SLAP 2 tear	Significant associated intra-articular injury: persistent pain	Rotator cuff tear and SLAP 2 tear	Rotator cuff repair and Bankart repair
24 y, male	Biking	2	Posterior labral tear	Persistent shoulder symptoms unresponsive to nonoperative treatment: persistent pain	Posterior labral tear	Posterior labral repair
20 y, male	Wrestling	3	SLAP 1 tear	Severity of AC injury	SLAP 1 tear	SLAP debridement and CC ligament reconstruction
52 y, female	Aikido	3	SLAP 2 tear	Severity of AC injury	SLAP 2 tear	SLAP repair and CC ligament reconstruction
21 y, male	Wrestling	3	No labral pathology	Persistent shoulder symptoms unresponsive to nonoperative treatment: instability	Anterior labral tear and SLAP 2 tear	SLAP repair and Bankart repair
53 y, male	Fall	3	SLAP 2 tear	Persistent shoulder symptoms unresponsive to nonoperative treatment: mechanical symptoms	Anterior labral tear and SLAP 2 tear	SLAP repair and Bankart repair
53 y, male	MVA	3	Rotator cuff tear and SLAP 1 tear	Persistent shoulder symptoms unresponsive to nonoperative treatment: persistent pain	Rotator cuff tear and SLAP 1 tear	Rotator cuff repair and SLAP debridement
21 y, male	Snowboarding	3	SLAP 2 tear	Severity of AC injury	SLAP 2 tear	SLAP repair and CC ligament reconstruction

[a]AC, acromioclavicular joint; CC, coracoclavicular; MRA, magnetic resonance arthrography; MVA, motor vehicle accident; SLAP, superior labral anterior-posterior.

current study ($P < .01$). Another age-matched historical control group consisting of recreational nonoverhead athletes and nonathletes (average age, 35 years) with pain, trauma, or dislocation demonstrated 56% of patients with labral tears on MRA.[8] Despite imaging for a suspected labral pathology, that cohort showed a lower incidence of labral pathologies compared with our overall cohort of acute AC separation ($P = .02$). Additionally, the incidence of labral tears in the general population has been shown to be low in asymptomatic patients. Chandnani et al[4] demonstrated no labral pathology on magnetic resonance imaging (MRI) in their cohort of healthy asymptomatic volunteers aged 25 to 55 years. Similarly, Reuter et al[27] found no evidence of labral pathologies on MRI in a cohort of asymptomatic triathletes.

DISCUSSION

The results of this study demonstrate a notable prevalence of IAPs for all grades of AC separation. While IAPs have previously been described in association with high-grade AC separation, the high prevalence of IAPs in low-grade separation in our study was unexpected. In grade 1 to 3 AC separation, there was a prevalence of associated labral pathologies in 74.5%, and a concomitant pathology in >1 intra-articular structure (combined IAPs) was present in 18 of 62 (29.0%) patients. Additionally, in patients younger than 40 years, 67.8% demonstrated labral pathologies.

Concomitant IAPs for lower grades of AC separation are often disregarded and thought to be of minimal clinical significance.[37] A study reported that over 65% of patients who failed nonoperative management of grade 3 AC separation had IAPs at the time of eventual operative management.[25] The management of AC separation can be difficult,[10,18,31] and a lack of information about associated pathologies may predispose these patients to less than optimal clinical outcomes.[25] Another study reported that 27% of nonoperatively treated grade 1 and 2 AC separation cases required further surgery.[20] The literature on associated pathologies in low-grade AC separation is limited, as nonsurgical treatment has been the mainstay.[18] The observed difference in our study may be explained by a close systematic follow-up, a shared decision-making approach, and diagnostic testing in a subpopulation that is not usually followed closely after the initial clinical evaluation. Last, the majority of cases of AC separation in our study were grades 1 to 3, which is consistent with previous reports.[7,21] The high prevalence of associated labral pathologies in grade 1 to 3 AC separation suggests the heightened importance of serial clinical examinations. An examination of acute AC separation can be difficult, as patients frequently demonstrate painful limitation of shoulder motion and strength along with an overlap of clinical tests for SLAP tears with symptoms from AC separation.

Although our cohort had a relatively young mean age of 37.6 years, a portion of the associated IAPs seen with AC separation in our study may certainly have been preexistent. Multiple studies have described a high prevalence of glenohumeral pathologies in asymptomatic shoulders of elite/professional overhead athletes,[5,14,19] and it has been

correlated with the number of innings pitched for pitchers.[16] These studies suggest that asymptomatic sequelae from a previous injury/overuse may lead to overtreatment; however, the vast majority of our cohort were recreational nonoverhead athletes or nonathletes. Further, in a recent study on high-grade AC separation, Pauly et al[23] reported that only 14.4% of IAPs were considered to be unrelated to recent trauma based on tissue appearance on arthroscopic surgery. Though previous studies have pointed out that shoulder pathologies can occur in both symptomatic and asymptomatic shoulders and increases with age,[9,29] there were multiple instances where pathology was seen in >1 structure or pathology like glenohumeral ligament avulsions observed in our study to suggest an acute traumatic etiology. Furthermore, patients younger than 40 years in our study with grade 1 to 3 AC separation demonstrated a high rate of associated labral pathologies (67.8%), consistent with the overall rate, and the age difference between patients with and without concomitant labral pathologies in our study did not reach significance. Similarly, the high percentage of high-grade labral tears (ie, SLAP ≥ 2 tear) seen in our cohort is more consistent with acute traumatic labral injuries. In their original description of SLAP tears, Snyder et al[33] stated that 11% of patients with SLAP tears had associated AC pathologies. Tischer et al[37] noted SLAP tears in 11 of 77 (14.3%) patients who were surgically treated and found that 16.7% of grade 5 AC injuries had a SLAP 2 to 4 tear. More recently, Jensen et al[12] reported 153 concomitant labral tears in their 376 patients (40.7%). However, their cohort (mean age, 42.1 years) had a mix of acute and chronic AC separation graded 3 or 4 that were treated surgically.

This is purely a descriptive study on the prevalence of associated IAPs in acute AC separation and does not intend to comment on surgical indications. It is our belief that clinical decision making should be made on a case-by-case basis through a combined approach using imaging with serial physical examinations to optimize care for this patient population. MRA may be an important diagnostic modality that a clinician should consider when clinically appropriate, as an acute physical examination may be unreliable. Although it may not be fiscally feasible for the routine use of MRA in the setting of acute AC separation, it offers a potent additional tool for diagnosis, especially in cases of failed nonoperative management. While we do not advocate it, several other authors have suggested the routine use of MRA to evaluate IAPs with AC separation.[23,37]

To our knowledge, this is the first study to systematically use MRA to assess for concomitant IAPs, specifically labral tears, associated with AC separation, regardless of severity. While the role of MRA in the diagnosis of labral tears is not without controversy,[17] MRA has been established as a standard diagnostic tool in suspected cases of labral pathologies,[34] with a reported 89% to 100% sensitivity, 69% to 91% specificity, and 74% to 92% accuracy for the detection of labral/SLAP lesions.[1,3,11] The accuracy rate of 84.6% (95% CI, 65.13%-95.64%) observed in our study is consistent with these previously reported rates. Still, there are reports suggesting that SLAP lesions are underdiagnosed with MRI. In 1 study, only 12 cases were accurately

diagnosed with preoperative MRI, while the remaining 70 cases were missed.[24]

A limitation to our study was that arthroscopic information on concomitant IAPs was not available for all low-grade AC dislocations, as the majority of these patients were treated nonoperatively. Additionally, the single surgeon was not blinded to the results of the preoperative MRA, and this could have introduced bias, particularly when classifying labral pathologies arthroscopically. Furthermore, there were no age-matched controls, and historical controls were used as a comparison instead. Using published series as control samples may introduce potential unknown confounders such as sampling bias, selection bias, and detection bias. Also, our cohort may have been underpowered, and this negatively affects the ability to detect an effect of age on the frequency of labral tears. The data for the patients included in this study are largely based on MRA, which is an imperfect tool. MRA may report false-positive readings (or false-negative results, as in our study), with variable accuracy for the diagnosis of labral/SLAP lesions.[30] However, we were able to demonstrate an acceptable accuracy of MRA findings in the patients who underwent arthroscopic surgery, and in a systematic review, MRA was found to have a specificity of 90.7% for the diagnosis of SLAP tears.[35] Additionally, as this was purely a descriptive study on the prevalence of associated IAPs in acute AC separation, patient-reported outcomes were not collected.

CONCLUSION

There was a high prevalence of IAPs among patients undergoing MRA after AC separation. While an IAP has been previously described in association with high-grade AC separation, the high prevalence of IAPs in low-grade separation in our study was unexpected and suggests that a thorough evaluation and clinical follow-up for patients with all grades of AC separation may be beneficial.

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