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Arthroscopic Treatment of Concomitant Superior Labral Anterior Posterior (SLAP) Lesions and Rotator Cuff Tears in Patients Over the Age of 45 Years

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Background: Rotator cuff tears commonly occur in combination with other shoulder injuries such as superior labral anterior posterior (SLAP) lesions. The incidence of these associated lesions increases with age; however, the management of concomitant SLAP and rotator cuff tears has yet to be convincingly addressed in the literature.

Hypothesis: Patients over the age of 45 years who have concomitant arthroscopic rotator cuff repair and debridement of their type II SLAP lesions will have improved patient satisfaction and functional outcome compared with those who undergo simultaneous rotator cuff and type II SLAP repair.

Study Design: Cohort study; Level of evidence, 2.

Methods: We recruited 48 patients (mean age, 51.9 years; range, 45-60 years) who had concomitant rotator cuff and type II SLAP tears. All underwent arthroscopic rotator cuff repair with subacromial decompression. Patients were randomized intraoperatively into 2 groups: repair versus debridement of their type II SLAP lesions. Ten patients were lost at final follow-up (4 in debridement and 6 in repair group). The outcome was assessed by the Tegner score and University of California at Los Angeles (UCLA) score and clinically to evaluate range of motion (forward elevation/internal rotation/external rotation).

Results: At 2 years postoperatively, both the debridement and repair groups showed significant improvement in Tegner score, UCLA score, and range of motion. Patients who underwent rotator cuff repair in combination with debridement of their SLAP tears had significantly better overall UCLA scores (34 vs 31; $P < .001$) and improved function (5.5 vs 3.8; $P < .005$) and pain relief (9.6 vs 7.7; $P < .001$) compared with those who underwent simultaneous rotator cuff and SLAP repair. Range of motion in both internal and external rotation was also significantly better in those patients who had SLAP debridement as compared to SLAP repair.

Conclusion: In patients over the age of 45 years with a minimally retracted rotator cuff tear and associated SLAP lesion, arthroscopic repair of the rotator cuff with combined debridement of the type II SLAP lesion may provide greater patient satisfaction and functional outcome in terms of pain relief and motion.

Keywords: SLAP; rotator cuff; labrum; shoulder arthroscopy

Rotator cuff tears are common injuries seen in the general population and increase in incidence among the aging. Early studies by Sher et al[13] and Tempelhof et al[17] looked at the prevalence of rotator cuff tears in the asymptomatic general population stratified by age. Sher et al showed that 28% and 54% of asymptomatic individuals between the ages of 40 and 60 years and greater than 60 years have rotator cuff tears as demonstrated by magnetic resonance imaging, respectively.[13] A follow-up study performed by Tempelhof et al found a direct correlation in the prevalence of rotator cuff tears as a function of aging.[17] Their study showed that asymptomatic patients in their 50s had a 13% prevalence of rotator cuff tears compared with a 51% prevalence in patients in their 80s.[17] Recently, Yamaguchi et al[19] examined the prevalence of rotator cuff tears in 588 patients who presented with unilateral shoulder pain. They also found a high correlation between increasing age

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and the onset of rotator cuff tears, with a 50% likelihood of bilateral rotator cuff tears in patients over the age of 66 years with unilateral shoulder pain.

The advent of shoulder arthroscopy has allowed for identification of new sources of shoulder pathological changes, particularly the superior labral anterior posterior (SLAP) lesion. This injury pattern was originally described by Andrews et al[1] in 1985 as a superior glenoid labrum tear related to the long head of the biceps. Snyder et al[15] subsequently coined the term "SLAP" lesion and divided this lesion into 4 distinctive types. These injuries are classically described as isolated lesions in the young throwing athlete; however, recent studies have demonstrated that combined lesions in the shoulder are very common and that rotator cuff tears are frequently associated with concomitant labral lesions.[6] Miller and Savoie[8] found that 74% of individuals with full-thickness rotator cuff tears had associated intra-articular lesions, with labral tears being the most commonly associated disorder. Furthermore, Snyder et al[14] arthroscopically examined 140 superior labral lesions and found that 40% were associated with a full- or partial-thickness rotator cuff tear. The general recommendation in the literature is to perform surgical repair of unstable type II SLAP lesions, but most of these outcome studies were performed in the younger athletic population and/or in those patients with isolated SLAP tears.[4,7] To date, no study has examined the clinical and functional outcome of arthroscopic rotator cuff repair combined with the treatment (debridement vs repair) of a concomitant type II SLAP tear in individuals over the age of 45 years.

MATERIALS AND METHODS

This study was approved and performed in accordance with the guidelines of the institutional review board at our hospital. This was a prospective cohort study of 48 patients over the age of 45 years who underwent arthroscopic treatment for both rotator cuff and SLAP lesions. All patients had isolated supraspinatus tendon tears that were minimally retracted with no fatty atrophy on magnetic resonance imaging (MRI) and had associated type II SLAP tears. Both the rotator cuff and type II SLAP lesions were confirmed intraoperatively via arthroscopy. Furthermore, all of the patients in our study were categorized as having repairable type II SLAP lesions that were demonstrated with complete detachment of the superior labrum from anterior to posterior with a positive peel back.[2] Patients were excluded from this study if they had any signs of adhesive capsulitis, other associated shoulder injury, and/or had any history of surgery or cortisone injection to the operative shoulder.

All 48 patients underwent arthroscopic rotator cuff repair and subacromial decompression by a single surgeon. A subgroup of 24 patients were treated with arthroscopic debridement of their type II SLAP tears, and the second subgroup of 24 patients underwent anchor placement and suture repair of their type II SLAP tears. Patients in our study were randomized into either the debridement or repair group intraoperatively with sealed envelopes, thus resulting in 24 per group. Of the 48 patients enrolled, 10 were lost to follow-up, 4 from the debridement group and 6 from the repair group. Our final follow-up included 20 patients in the debridement and 18 patients in the repair group.

TABLE 1
University of California at Los Angeles (UCLA) Score
(maximum score = 35)

Function/Reaction Measured
Pain
1 = all the time/unbearable
0 = no pain
Function
1 = unable to use limb
0 = normal activity
Active forward flexion
0 = less than 30°
5 = 150° or more
Strength of forward flexion
0-5 on standard manual muscle testing scale
Satisfaction
0 = not satisfied/worse
5 = satisfied/better

Outcome measures consisted of Tegner scores, University of California at Los Angeles (UCLA) scores, and clinical assessment of range of motion at 1 and 2 years after surgery. The Tegner score is a self-reported activity level scale first adapted for the rating of knee injuries.[16] The patient's level of activity is rated from 0 to 10, with 0 being complete disability and 10 being able to participate in highly competitive sports at an elite/professional level. The UCLA score (Table 1) assesses pain, function, active forward elevation, strength of forward motion, and patient satisfaction with a maximum score of 35. Range of motion in internal rotation, external rotation, and forward elevation was also assessed by a single physical therapist with the patient in the supine position and the scapula stabilized. The physical therapist was blinded to the type of the surgery (debridement vs repair), and all patients had the same postoperative rehabilitation protocol, which was a standard rotator cuff repair protocol. The operative surgeon was also blinded to the results of all outcome measures. Statistical analysis of the data was performed by the Student t test with significance set at $P < .05$.

RESULTS

The initial 48 patients in this study had a mean age of 51.9 years (range, 45-60 years). Of the original 48 patients enrolled, 10 were lost at the final follow-up, 4 from the debridement group and 6 from the repair group. The 20 patients treated with debridement of their type II SLAP tear had a mean age of 51.2 years (range, 45-60 years), with 11 of 20 (55%) of these injuries affecting the dominant extremity. The 18 patients who underwent type II SLAP repair with suture anchors had a mean age of 52.6 years (range, 47-60 years), with 10 of 18 (55%) injuries affecting the dominant extremity.

TABLE 2
Functional Change Preoperatively to Postoperatively Within Debridement and Repair Groups

	Debridement			Repair		
	Preoperative	Postoperative	*P* Value	Preoperative	Postoperative	*P* Value
Tegner score (max = 10)	2.5 (±0.6)	5.6 (±1.5)	<.001	2.2 (±0.7)	5.1 (±1.3)	<.001
Overall UCLA (max = 35)	17.4 (±2.8)	34 (±2.1)	<.001	17.9 (±3.8)	31 (±2.7)	<.001
Pain (max = 10)	4.2 (±1.5)	9.6 (±0.8)	<.001	3.7 (±2.1)	7.7 (±1.4)	<.001
Function (max = 10)	4.1 (±1.4)	9.6 (±0.8)	<.001	5 (±1.7)	8.8 (±1.0)	<.001
Forward flexion (max = 5)	5 (±0)	4.9 (±0.3)	.07	5 (±0)	4.8 (±0.4)	.03
Strength (max = 5)	4.2 (±0.4)	4.9 (±0.3)	<.001	4.2 (±0.4)	4.7 (±0.5)	<.001
Satisfaction (max = 5)	0 (±0)	5 (±0)		0 (±0)	5 (±0)	

TABLE 3
Comparison of University of California at Los Angeles (UCLA) Scores at 2 Years Postoperatively

	Debridement	Repair	*P* Value
Overall UCLA (max = 35)	34 (±2.1)	31 (±2.7)	<.001
Pain (max = 10)	9.6 (±0.8)	7.7 (±1.4)	<.001
Function (max = 10)	9.6 (±0.8)	8.8 (±1.0)	<.005
Forward flexion (max = 5)	4.9 (±0.3)	4.8 (±0.4)	.27
Strength (max = 5)	4.9 (±0.3)	4.7 (±0.5)	.08
Satisfaction (max = 5)	5 (0)	5 (0)	
Functional improvement[a]	5.5 (±1.1)	3.8 (±1.9)	<.001

[a]Because the debridement and repair groups differed in UCLA function score preoperatively, a functional improvement score was calculated (function postoperatively – function preoperatively = functional improvement) for each subject and compared.

TABLE 4
Comparison of Range of Motion at 1 and 2 Years Postoperatively[a]

	Debridement	Repair	*P* Value
1 year postoperatively			
IR	69.3 (±11.3)	36.1 (±23.9)	<.001
ER	84.3 (±9.8)	68.6 (±12.8)	<.001
FF	166.0 (±4.8)	161.9 (±10.5)	.05
2 years postoperatively			
IR	69.8 (±11.8)	37.8 (±23.8)	<.001
ER	84.8 (±9.0)	69.7 (±12.5)	<.001
FF	166.5 (±4.9)	163.1 (±10.0)	.08

[a]IR, internal rotation; ER, external rotation; FF, forward flexion. All measured by a single therapist with the patient supine and the scapula stabilized.

Preoperatively, there was no statistical difference between the debridement versus repair groups in terms of the Tegner score, overall UCLA score, and range of motion. Of note when examining the preoperative subgroups of the UCLA score, the debridement group had a significantly lower functional score (4.1 ± 1.4) than the repair group (5 ± 1.7). Both groups showed significant improvement in all categories from their preoperative to postoperative status except in the UCLA forward flexion subcomponent (Table 2).

Postoperatively (Table 3), the debridement group showed significantly better overall UCLA scores (34 ± 2.1 vs 31 ± 2.7; $P < .001$), specifically in the areas of pain relief (9.6 ± 0.8 vs 7.7 ± 1.4; $P < .001$) and function (9.6 ± 0.8 vs 8.8 ± 1.0; $P < .005$). Range of motion in forward flexion, internal rotation, and external rotation was also significantly better in the debridement group at the 1-year postoperative follow-up. Furthermore, the debridement group showed persistently improved internal and external rotation at the 2-year final follow-up (Table 4).

DISCUSSION

Shoulder injury rarely occurs in isolation, with up to 80% of rotator cuff or SLAP tears having combined lesions.[5,8,9,14] Despite this fact, most studies have excluded subjects with combined lesions to remove confounding variables that may obscure data. Moreover, most studies on SLAP lesions have focused on younger (<40 years) competitive athletes.[4,7] Age has been shown as a significant factor in shoulder injury. The incidence of rotator cuff tears is strongly correlated with increasing age, and recent research shows that the glenoid labrum demonstrates histological changes that include loss of chondrocytes and decrease in vascularity (especially superiorly) with aging.[3,11]

In 2001, Savoie et al[12] reported on the prevalence and treatment of anterior superior shoulder instability with rotator cuff tearing (termed a SLAC lesion) in 40 patients with an average age of 43 years. Of the 40 patients, 37 demonstrated partial-thickness undersurface tears, while 3 had supraspinatus tears on the bursal side with an intact capsule. Their study concluded that in patients who failed conservative management of the SLAC lesion, anatomical repair of the SLAP tear with debridement of the partial-thickness rotator cuff tear provided effective treatment. However, their study had no objective measures of postoperative function, and no discussion was made as to the treatment and outcome of those with a full-thickness rotator cuff tear and associated superior labral lesions.

Recently, Voos et al[18] presented a retrospective cohort study of 30 patients (mean age, 47.8 years) who underwent

arthroscopic repair of combined rotator cuff and labral tears, including both SLAP (n = 14) and Bankart (n = 16) lesions. Clinical outcomes were compared between those undergoing arthroscopic repair of combined rotator cuff and SLAP tears versus combined rotator cuff and Bankart lesions. Results of both groups were also compared with the contralateral, nonoperative shoulder. Overall there was significant improvement postoperatively in range of motion in forward elevation (20.5°; $P = .005$), external rotation (9.0°; $P = .008$), and internal rotation (2 vertebral levels; $P = .016$). The authors concluded that concomitant repair of combined rotator cuff and labral lesions resulted in good clinical outcomes. A significant limitation in that study was that the authors used the opposite, unoperated shoulder as the control group for comparison and the overall results were reported with combined data from both the Bankart and SLAP repair group. When one looks at the subgroup of SLAP/rotator cuff repair, the results showed no significant improvement in motion preoperatively versus postoperatively, while a trend of loss of motion in internal rotation was observed (–1.0° and –1 vertebral level). Furthermore, lower levels of motion improvement in external rotation and forward elevation were also observed in the SLAP/rotator cuff repair group when compared with the Bankart/rotator cuff repair group.

A recent randomized controlled trial done by Franceschi et al[5] prospectively reported on 63 patients over the age of 50 years who underwent concomitant arthroscopic rotator cuff repair with either a SLAP repair or tenotomy of the long head of the biceps for rotator cuff tears associated with type II SLAP lesions. At a minimum 2.9-year follow-up, both groups had significant improvement in the UCLA score and range of motion values from preoperative values. However, patients in the biceps tenotomy group had statistically significantly better results in function (9.2 vs 7.3), active forward flexion (4.8 vs 3.8), and satisfaction (4.6 vs 3.4). Furthermore, these patients also had significantly improved results in range of motion in all 3 categories of forward flexion, external rotation, and internal rotation. The authors concluded that there is no advantage in repairing a type II SLAP lesion when associated with a rotator cuff tear in patients over the age of 50 years and recommended biceps tenotomy. However, a disadvantage of performing a biceps tenotomy is the distal migration of the tendon resulting in a cosmetic deformity (Popeye sign) and impaired shoulder strength. In the above study, 19 of 31 patients had this deformity at rest or with flexion. The authors also recognized that further studies are needed to evaluate whether minimum intervention to the type II SLAP lesions when associated with a rotator cuff tear can have the same clinical outcome as biceps tenotomy.

To our knowledge, this is the first randomized prospective cohort study to look at a specific subset of combined rotator cuff and labral lesion (type II SLAP) with objective assessment made not only between preoperative and postoperative function but also between 2 specific operative interventions: SLAP debridement and SLAP repair. All patients in our study had arthroscopic rotator cuff repair and subacromial debridement in addition to treatment of the SLAP lesions. Thus the management of the rotator cuff tear in our study group was held constant, which allowed for comparison of functional outcomes after type II SLAP debridement versus repair. A major strength of our study is that all of the operations were performed by a single sports fellowship–trained surgeon using a well-established technique with all of the follow-up assessment done by a single physical therapist who was blinded to the surgical groups. Also final follow-up was greater than 2 years, which allows for adequate evaluation of the clinical outcomes after a surgical intervention. This is also the first study looking at the outcomes in patients after minimal intervention (debridement) of a type II SLAP tear associated with a rotator cuff tear in patients over 45 years of age.

Similar to the above studies, we observed improvement from preoperative to postoperative function in both of the combined treatment groups (Table 2). Both groups also expressed satisfaction in their postoperative results, with the mean UCLA patient satisfaction subscore of 5 for both treatment groups. When looking at the functional outcome of debridement versus repair at the 2-year follow-up, the debridement group demonstrated significantly better overall UCLA functional scores (34 ± 2.1 vs 31 ± 2.7; $P < .001$), especially in the categories of pain relief (9.6 ± 0.8 vs 7.7 ± 1.4; $P < .001$) and function (9.6 ± 0.8 vs 8.8 ± 1.0; $P < .005$). The debridement group also had significantly better range of motion at both 1 year and 2 years after operation, particularly in internal (69.8° vs 37.8°; $P < .001$ [2 years]) and external rotation (84.8° vs 69.7°; $P < .001$ [2 years]) (Table 4).

Historically, patients with minimally retracted rotator cuff tears do well with primary repair. With increasing use of shoulder arthroscopy, new types of shoulder lesions, such as the SLAP lesion, have been identified. Appropriate management of these lesions is still under investigation, particularly given the wide age range and physical demands of the population affected. Young and high-demand overhead athletes do well with anatomical repair of their SLAP lesions, but these lesions are usually isolated. Given the large forces generated by throwing and overhead activities, another essential component to good clinical outcome is stabilization of the biceps anchor insertion. However, in the older (>45 years) individual with lower demands, the necessity of SLAP repair is less clear, particularly if no symptoms of labral instability are present.

When combined lesions exist, specifically rotator cuff and SLAP tear, the decision-making process becomes even more complicated. With aging, there is decreased compliance of the superior glenoid labrum and vascularity of the rotator cuff tendons. This may account for the high prevalence of rotator cuff and type II SLAP tears in the population over the age of 45 years. It may be that the development of type II SLAP tears in this population is a compensatory response to the decreased compliance of the superior glenoid labrum that would allow for maintenance of range of motion in the aging shoulder. Our study demonstrated that in the 2 populations that were otherwise equivalent, SLAP repair resulted in loss of range of

motion, decreased objective pain relief, and function when compared with SLAP debridement.

There is also a concern for shoulder instability after a type II SLAP tear. Previous biomechanical studies have demonstrated increased glenohumeral translation with simulated type II SLAP tears.[10] This finding may explain the feeling of instability in the overhead active athlete. However, a recent biomechanical study demonstrated that a simulated type II tear does not significantly alter the path of glenohumeral articulation in the face of translation. Thus, in a type II SLAP lesion without pain or mechanical symptoms, surgical repair may not be needed.[20]

One significant limitation of our study is that 10 patients (20%) were lost at the final follow-up (4 in the debridement group and 6 in the repair group). All patients lost to follow-up had fully recovered from their rotator cuff repair (plus type II SLAP repair or debridement) and were clinically satisfied on their final follow-up visit and failed to return after 4 months for continued assessment. However, we cannot comment on the clinical outcome of these patients at the 1- and 2-year time point. The difference in patient loss to follow-up between the 2 treatment groups is 2 patients, which we believe did not skew our final results.

CONCLUSION

Patients over the age of 45 years treated with arthroscopic rotator cuff repair and SLAP debridement had significantly better function, pain relief, and range of motion than those treated with rotator cuff repair and simultaneous SLAP repair. Thus, in patients with a minimally retracted rotator cuff tear and an associated type II SLAP lesion, repair of the rotator cuff with minimal intervention to the SLAP lesion may provide greater patient satisfaction and functional outcome, particularly in terms of pain relief and motion.

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