Return to Play After Treatment of Superior Labral Tears in Professional Baseball Players

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Return to Play After Treatment of Superior Labral Tears in Professional Baseball Players

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Background: The published return-to-play (RTP) rates for athletes who have undergone surgical repair of superior labrum anterior-posterior (SLAP) tears vary widely and are generally accepted to be lower in the subset of competitive throwers. The efficacy of nonsurgical treatment for this group is unknown.

Hypothesis: Nonsurgical treatment of SLAP tears in professional baseball players leads to RTP before consideration of surgical treatment. Incorporating performance statistics and level of competition will result in lower calculated RTP rates than have been previously reported.

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

Methods: A retrospective review of 119 consecutive patients in a single professional baseball organization with persistent shoulder pain that limited the ability to compete was performed. Sixty-eight patients had magnetic resonance imaging–documented SLAP lesions. All patients had failed 1 attempt at rehabilitation but had continued with supervised physical therapy. Treatment was according to an algorithm focusing on the correction of scapular dyskinesia and posterior capsular contracture with glenohumeral internal rotation deficit (GIRD), followed by pain-free return to throwing. Those who failed 2 cycles of nonsurgical treatment were treated surgically. Success was defined by 2 different standards: (1) RTP, in accordance with previous studies; and (2) a more stringent standard of return to the same level/quality of professional competition (A, AA, AAA, etc) with the incorporation of a return to preinjury individual performance statistics (earned run average, walks plus hits per inning pitched), termed ''return to prior performance'' (RPP).

Results: Sixty-eight athletes were identified with SLAP lesions. Twenty-one pitchers successfully completed the nonsurgical algorithm and attempted a return. Their RTP rate was 40%, and their RPP rate was 22%. The RTP rate for 27 pitchers who underwent 30 procedures was 48%, and the RPP rate was 7%. For 10 position players treated nonsurgically, the RTP rate was 39%, and the RPP rate was 26%. The RTP rate for 13 position players who underwent 15 procedures was 85%, with an RPP rate of 54%.

Conclusion: Nonsurgical treatment correcting scapular dyskinesia and GIRD had a reasonable success rate in professional baseball players with painful shoulders and documented SLAP lesions. The rate of return after surgical treatment of SLAP lesions was low for pitchers. The RTP and RPP rates were higher for position players than for pitchers. Nonsurgical treatment should be considered for professional baseball players with documented SLAP lesions, as it can lead to acceptable RTP and RPP rates.

Keywords: superior labral tears; SLAP; baseball; thrower's shoulder

Shoulder injuries can be a significant source of pain and dysfunction among athletes. First described by Andrews et al[1] and subsequently classified by Snyder et al,[23] lesions of the superior labrum can cause loss of function and diminished sports participation. The efficacy of surgical treatment of superior labrum anterior-posterior (SLAP) lesions has become well established in the literature, with the restoration of pain-free shoulder function during activities of daily living.[2,13,25]

Shoulder injuries in overhead athletes, specifically those who throw, can be a debilitating condition that can severely limit or end the ability to participate. Since being recognized as a clinically important entity in the

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pathological throwing shoulder,[3-6] SLAP lesions have commonly been treated with surgery. Initially, high rates of return to play (RTP) were reported.[7,20,22] Recently, however, the efficacy of surgical treatment with a return to a high level and elite throwing, specifically pitching, has been questioned.[8,10,17,18]

Nonsurgical treatment of SLAP lesions has been reported as having efficacy in decreasing pain and increasing function with regard to activities of daily living.[9] To our knowledge, the efficacy of nonsurgical treatment of SLAP lesions in overhead athletes has not been reported. Previously published studies have used subjective questionnaires to assess posttreatment function. The aim of our study was to assess the efficacy of treatment with regard to athletic ability and ability to continue participation. Therefore, using athletes' performance statistics, we hypothesized that nonsurgical treatment of SLAP lesions could lead to a high rate of RTP and specifically return to prior performance (RPP).

MATERIALS AND METHODS

A retrospective chart review of 119 consecutive Major League Baseball (MLB) and minor league baseball players in a single professional baseball organization with persistent shoulder pain that limited the ability to compete was performed. Institutional review board approval was granted before data collection. All players had failed an attempt at rehabilitation before presentation. Sixty-eight players had magnetic resonance imaging (MRI)–documented superior labral tears. These were all type II or type II posterior variant tears. Of the 68 players identified, 45 were pitchers and 23 were positional players.

The nonsurgical treatment was an algorithm designed by the senior author (D.M.L.) that focused on correcting (1) glenohumeral internal rotation deficit (GIRD), (2) scapular dyskinesia, (3) posterior capsular (cross-body) contracture, and (4) any concomitant injuries. Athletes completed 2 courses of physical therapy before being considered for surgical treatment. The initial rehabilitation regimen was conducted in the player's city (minor league or major league team) and consisted of the identification of strength and motor pattern deficits (eg, scapular dysrhythmia) and therapeutic exercises directed from these findings. Open and closed chain rotator cuff exercises with dumbbells and tubing were performed and included eccentric rotator cuff exercises. Stretching of the posterior capsule was performed daily in a nonballistic manner in internal rotation at 90° of abduction (sleeper stretch) and also cross-body stretching of the posterior capsule with the scapula stabilized after the player warmed up via cardio or light rotator cuff exercises.

In the second phase, the treatment was continued with a more focused program under the supervision of a physical therapist skilled in the management of throwers. In addition, a more intensive program of core strengthening, posture/rhythm of the scapula, hip and lower extremity alignment during the windup, and the thrower's awareness of his posture and scapular position during the throwing motion was implemented.

During both phases, a graduated throwing program was instituted; the general structure can be seen at http://www.drlintner.com/rehab-protocols/miscellaneous-protocols/graduated-throwing-program/. This program was modified to accommodate individual needs such as position played, time off of throwing to date, and recurrent pain, among others. Posterior capsular tightness was monitored during the throwing program to ensure that it did not worsen in response to the throwing. During the rehabilitation periods, nonsteroidal anti-inflammatory drugs were used routinely, and subacromial cortisone injections were added for acute flares.

The surgical treatment of SLAP lesions was repair with suture anchors or debridement based on decision making at the time of surgery. Indications for surgery were the inability to perform at the player's desired level because of shoulder pain despite documented improvement in posterior capsular tightness and scapular kinetics. The surgical procedures were performed by 7 different surgeons both within and outside of the organization. All surgeons had experience in treating professional athletes.

Previous studies[3,7,8,10,17,18,22] have defined the concept of success based on a player's ability to return to competition, referred to as RTP. We applied this definition of success to our patient population. We then applied a more strict definition that included the level of competition and on-field performance statistics. The first definition required the successful completion of spring training (if a return was attempted after conclusion of the season) and participation in at least 1 competitive game in any league, regardless of the league at the time of injury. The second definition, RPP, comparatively evaluated both the level of competition (league level) and the statistics of the player before injury and after returning. All player performance statistics were acquired from an online database (www.Baseball-Reference.com).

Each player's career was tracked chronologically, noting age, league level (independent, A+/–, AA, AAA, MLB), games played, time of injury, and position-relevant statistics. The relevant statistics for pitchers were game appearances, games started, innings pitched, earned run average (ERA; the number of earned runs allowed per 9 innings pitched), and number of walks plus hits per inning pitched (WHIP). The relevant statistics of position players were plate appearances, batting average, slugging percentage (total bases achieved by a player's hits divided by the total at bats), and fielding percentage (the accuracy with which a player handles a batted or thrown ball).

With regard to RPP, failure to play a full season or at least 1 season after returning was considered not successful. Failure to maintain the same league or ascend league levels was considered not successful. Additionally, if a pitcher was transitioned from a starter to a reliever after returning, it was considered a lower level of performance and therefore not successful. Failure to achieve statistics similar to those at the time of injury, regardless of time played after returning, was considered not successful. For pitchers who returned for at least 1 year and to their same or higher league, an ERA within 2.00 and WHIP within 0.500 were considered similar to before their injury.

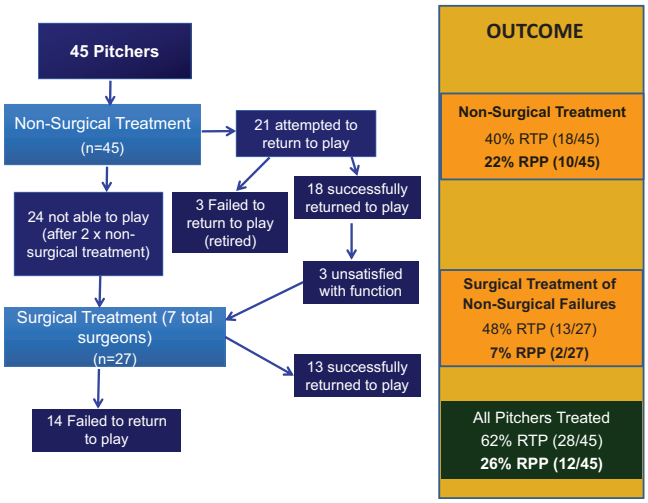

Figure 1. Treatment algorithm results for pitchers.

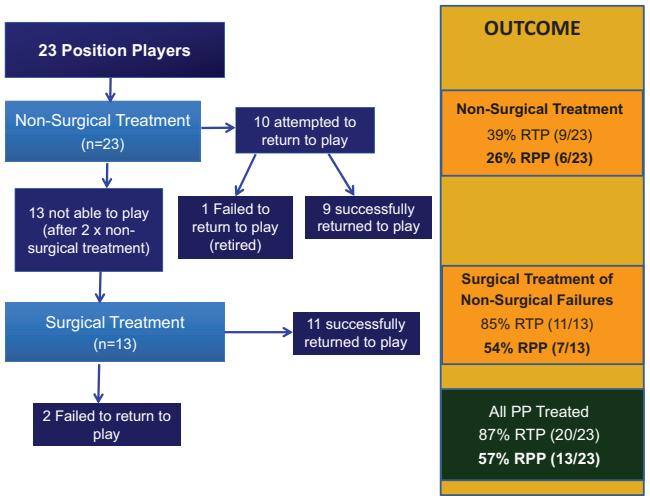

Figure 2. Treatment algorithm results for position players.

For position players, a batting average of within 0.100 was considered similar. This came into consideration for only several athletes in the study, as many failed to return for at least 1 year or to maintain their preinjury league level. Athletes with concomitant anteroinferior (Bankart) labral lesions (1 pitcher and 3 position players) were excluded.

Pairwise comparisons were carried out using a 2-sided Fisher exact test for RTP and RPP for pitchers compared with position players and MLB/AAA pitchers compared with AA/A/rookie league pitchers after both nonsurgical and surgical treatment.

RESULTS

Of 68 professional baseball players with MRI-documented SLAP lesions, 45 were pitchers. Their ages ranged from 17 to 42 years (mean age, 23.7 years). After therapy, 21 attempted a return. Eighteen met criteria for a successful RTP, for a rate of 40% (18/45). The RPP rate was 22% (10/45). The mean age of those who met RPP criteria was 25.1 years. Twenty-seven pitchers, including 3 who had previously attempted a return after completion of the nonsurgical algorithm, underwent 30 procedures and had an RTP rate of 48% (13/27). The RPP rate for this group was 7% (2/27). The mean age of those who met RPP criteria was 24 years. Overall, the algorithm yielded an RTP rate of 62% (28/45) and an RPP rate of 27% (12/45) (Figure 1).

Twenty-three position players were identified in our review. Their ages ranged from 17 to 37 years (mean age, 23.9 years). Of these, 10 attempted a return after therapy. Their RTP rate was 39% (9/23); the RPP rate was 26% (6/23). The mean age of those who met RPP criteria was 23.6 years. Thirteen position players who underwent 15 procedures had an RTP rate of 85% (11/13). The RPP rate was 54% (7/13). Those who met RPP criteria had a mean age of 22.7 years. Overall, the algorithm yielded an RTP rate of 87% (20/23) and an RPP rate of 57% (13/23) (Figure 2). Position players returned at a statistically higher rate with regard to both RTP and RPP compared with pitchers after surgical treatment ($P = .0402$ and .0023, respectively).

TABLE 1
Treatment Results for Pitchers With at Least 30% Partial Rotator Cuff Tears (n = 12 Pitchers)[a]

	RTP Rate	RPP Rate
Nonsurgical treatment	25 (3/12)	8 (1/12)
Surgical treatment	33 (3/9)	0 (0/9)
Total regimen	50 (6/12)	8 (1/12)

[a]Values are expressed as percentage (successful number of RTP or RPP/total). Among 12 identified pitchers, 4 completed the nonsurgical protocol, and 9 underwent 11 procedures only after failing to return to play following completion of the nonsurgical protocol. RPP, return to prior performance; RTP, return to play.

Twelve pitchers were identified with concomitant rotator cuff tears (RCTs) of at least 30% thickness. Of these, 4 attempted a return after nonsurgical treatment and had an RTP rate of 25% (3/12) and an RPP rate of 8% (1/12). Nine pitchers with concomitant RCTs underwent 11 procedures and had an RTP rate of 33% (3/9). None returned to their prior performance. Overall, the algorithm yielded an RTP rate of 50% (6/12) and an RPP rate of 8% (1/12) (Table 1).

Eight athletes were identified as having concomitant rotator cuff repairs. There were 5 pitchers and 3 position players. Of these athletes, only 1 participated in a competitive game again.

Of 18 MLB or AAA pitchers with SLAP lesions, 10 attempted a return after nonsurgical treatment. The RTP rate was 44% (8/18), and the RPP rate was 33% (6/18) for this group. For MLB or AAA pitchers who underwent surgical treatment, including 1 who had returned after nonsurgical treatment, the RTP rate was 69% (9/13), and the RPP rate was 15% (2/13). The remaining pitchers were at the AA, A, or rookie league level at the time of injury. The RTP rate for this group after nonsurgical treatment was 37% (10/27), and the RPP rate was 15% (4/27). For

TABLE 2
Comparison of RTP and RPP for Pitchers Who Underwent Nonsurgical and Surgical Treatment With Respect to Level of Competition Before Injury[a]

	AAA/MLB (n = 18)		Rookie/A/AA (n = 27)	
	RTP Rate	RPP Rate	RTP Rate	RPP Rate
Nonsurgical treatment	44 (8/18)	33 (6/18)	37 (10/27)	15 (4/27)
Surgical treatment	69 (9/13)	15 (2/13)	24 (4/17)	0 (0/17)

[a]Values are expressed as percentage (successful number of RTP or RPP/total). Of the 18 MLB or AAA pitchers with superior labrum anterior-posterior lesions, 10 attempted to return after nonsurgical treatment, and 13 underwent surgical treatment; of the 27 pitchers at the AA, A, or rookie level at the time of injury, 11 attempted to return after nonsurgical treatment, and 17 underwent surgical treatment. MLB, Major League Baseball; RPP, return to prior performance; RTP, return to play.

17 AA, A, or rookie pitchers who underwent surgery, the RTP rate was 24% (4/17). No pitcher at the AA, A, or rookie level returned to prior performance after surgical treatment (Table 2). The MLB and AAA pitchers returned at a statistically higher rate with regard to RTP compared with AA, A, and rookie pitchers after surgical treatment ($P = .0247$).

DISCUSSION

The presence of MRI-diagnosed but asymptomatic SLAP tears in throwers is high.[1] The number of SLAP repairs performed annually in the United States is increasing and has become one of the most frequently performed procedures by young orthopaedic surgeons.[19,26] However, a growing body of information indicates that scapular dyskinesia and posterior capsular tightness play significant roles in generating pain in the shoulder with or without the presence of an MRI-diagnosed SLAP lesion.[11,12,27] Nonsurgical treatment of these disorders can improve the patient's pain and restore function in a number of cases and should be attempted before proceeding to surgery. In our algorithm, patients came to our office only after having failed an initial attempt at rehabilitation with their team trainer in their respective team city. All players then underwent magnetic resonance arthrography and began a second round of physical therapy. Those with documented SLAP lesions made up our study population. Thus, 40% (27/68) of players who had already failed nonsurgical treatment were successful with regard to RTP on their second attempt, and 24% (16/68) returned to their prior performance. The rehabilitation protocol focused on relative rest, cross-body stretching with the scapula stabilized, internal rotation stretching in 90° of abduction and sleeper position, and training of the scapula's posture during early windup through the cocking phase of the throw. This is often the most challenging part of the rehabilitation regimen because the stable scapular position feels unnatural to athletes, and they revert to their baseline kinematics by habit. Before progressing to graduated throwing, the athlete must demonstrate improvement in the above parameters and be pain free.

Previous studies have used subjective questionnaires in determining success after treatment for SLAP lesions.[2,10,13,14,17,18,24] In some studies, these were administered before the athlete had actually returned to competition.[16] For the overhead athlete, studies have shown that the standard assessment scores may be inadequate for assessing success after treatment.[17,18] In our study, performance statistics were used as a more objective reflection of an athlete's progress after treatment.

Our study confirmed the findings of several previous studies. Morgan et al[16] reported a 31% incidence of partial articular RCTs in a series of 102 patients with SLAP lesions. Reynolds et al[21] noted difficulty in returning to the preinjury level of performance after arthroscopic debridement of small partial RCTs in elite overhead throwers. In patients with 10% to 40% partial RCTs, Neri et al[17] reported the decreased efficacy of SLAP repair in elite overhead throwers. In our study, the presence of concomitant partial RCTs worsened outcomes of both nonsurgical and surgical treatment in baseball players. Mazoue and Andrews[15] reported an 8% return after rotator cuff repair in professional pitchers, and our study confirmed this in the setting of concomitant surgical treatment for SLAP lesions.

Athletes who were injured while playing in a higher league (MLB or AAA) both returned to play and returned to their previous level at a higher rate than those injured while playing at a lower level (AA, A, or rookie). This may be caused by several factors. Athletes already playing at a higher league level have demonstrated a higher level of ability and durability and therefore are able to continue at a high level when compared with those at a lower level. An athlete injured at a lower level may not have as much incentive to continue his career as an athlete in a higher league. In short, better players return to play and return to prior performance at higher rates. The rate of attrition for uninjured players of a similar level and age must be factored in. Finally, by failing 2 stringent rehabilitation attempts, only the most severe cases went on to surgery.

Procedures performed in this review consisted of labral debridement and, in others, repair. Martin and Garth[14] reported a 62% success rate for baseball pitchers after debridement. Tomlinson and Glousman[24] reported a 75% success rate in 12 of 16 professional baseball players after labral debridement. In this review, both pitchers who successfully returned to prior performance after surgical treatment underwent debridement only. Despite a 60% (12/20) RTP rate, no pitcher who had undergone labral repair was considered successful in returning to his prior

level of performance. It is possible that surgical debridement is less disruptive to the biomechanics of pitching than surgical repair.

Another finding of our study was that position players responded to both nonsurgical and surgical treatment of SLAP lesions better than did pitchers at all levels. This is likely because a pitcher's performance is heavily dependent on the extremes of shoulder motion and angular velocity, the high volume of throwing required, and the narrow definition of success. Getting batters out is different than being able to throw hard, and the margin of error is slim. While the ability of a position player is also dependent on shoulder function, there is considerably less demand than that of a pitcher. The emphasis for position players is on offensive statistics, which are less dependent on shoulder function. Infielders on the right side of the field have short and less frequent throws. Our numbers do not allow analysis by specific position played.

Even in players who failed an initial course of rest and physical therapy, additional nonsurgical treatment led to successful outcomes. We recommend that considerable effort be focused on this early stage of treatment both because it can be successful and because in those who do not respond to continued nonsurgical treatment, surgery is often unable to rescue their baseball career. In our review, the success of surgical treatment of SLAP lesions in baseball players was lower than previously reported.[7,8,14,17,22,24] The primary reason for this is a more stringent definition of success. We have applied a new outcome measure, the RPP rate, which we believe should supplant the notion of RTP because it is a true measure of success as defined by the injured athletes and their teams. Performance statistics were used to determine not only the presence of a return attempt but also the quality of a return attempt. If an athlete returned to play but this return was to a less competitive league (MLB to AAA, AA to A, etc), then this was not considered a return to the prior level. If an athlete returned to the same league as that at the time of injury but with worsened performance statistics, this was not considered a return to the prior level. Similarly, a brief RTP (less than 1 full season) was considered a failure. When counseling a player, parent, or other interested party about the likelihood of success of the proposed treatment, one must consider what they would consider a success: the return to a similar level of preinjury performance for a sustained period.

Our study has several limitations. It is not a prospective study, and those who went on to surgery had failed nonsurgical treatment. Therefore, the nonsurgical and surgical groups cannot be compared, and only the most severe cases fell into the surgical group. Also, the criteria for success were stringent. However, it is our view that these performance metrics are what is truly important to the athletes and team administration. Several athletes returned to competition in a different role and made contributions, but with poorer statistical performance compared with before the injury. One athlete, after surgical treatment for a SLAP lesion, was unable to continue as a pitcher in the minor leagues but continued as a position player. Several pitchers continued their careers as relief pitchers, with performance statistics that were inferior to their preinjury level, as is typical for relief pitchers. Seven different surgeons performed the procedures in this group of professional players, increasing the variability of surgical technique but decreasing observer and treatment bias. Finally, we need to compare these results to the natural performance/progression/attrition of uninjured professional baseball players to obtain a true comparison group.

CONCLUSION

The treatment of SLAP tears in professional baseball players is challenging. Since the recognition of superior labral tears as a clinical entity, several studies have reported variable success rates for surgical treatment in overhead athletes. Our review supports the recent literature indicating that a return to the preinjury level of competition is problematic, especially in elite pitchers. Previously used measures of "success" overestimate the return to on-the-field performance after surgery for SLAP lesions. Nonsurgical treatment consisting of correcting scapular dyskinesia and GIRD/posterior capsular tightness has an acceptable success rate when considering that surgical treatment does not result in a reliably high return to previous performance. A concomitant rotator cuff injury has a negative effect on prognosis. Position players tolerate lesions of the superior labrum better than do pitchers. Career continuation and RPP were more likely in pitchers competing at a higher professional level. Surgical debridement of SLAP tears may be more effective than repair. Extended nonsurgical treatment should be considered before surgical treatment in professional baseball players.

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