In Throwers With Posterior Instability, Rotator Cuff Tears Are Common but Do Not Affect Surgical Outcomes

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Take-Home Points

- Arthroscopic capsulolabral reconstruction is successful in throwing athletes with concomitant RCTs treated with arthroscopic débridement.
- A previous study of throwing athletes found poor outcomes after surgery for concomitant SLAP tears and RCTs.
- Throwing athletes with concomitant posterior shoulder instability and RCTs were no different in patient-reported outcomes or return to play.
- The high proportion of throwing athletes with partial thickness RCTs in this study (43%) indicates a need for close evaluation of rotator cuff pathology in young throwing athletes.
- The authors theorize the main pain generator in this population may be posterior instability and that the rotator cuff has less of an influence.

Posterior shoulder instability is an important and increasingly recognized pathology among throwers. Like the superior labrum, the posterior capsulolabral complex is also susceptible to injury during the throwing motion; the posterior labrum being most at risk during the late cocking and follow-through phases. Recent studies have found that arthroscopic capsulolabral reconstruction in posterior shoulder instability is successful in allowing athletes to return to their preinjury sports activities, with 2 studies detailing outcomes in throwing athletes.14 However, superior labral anterior posterior (SLAP) tears are common in throwing athletes and have been treated with varying and limited success. Further, in a study of outcomes of arthroscopic repair of SLAP lesions, Neri and
colleagues found that, compared with throwing athletes with SLAP tears, throwing athletes with concomitant SLAP tears and partial-thickness rotator cuff tears (RCTs) had significantly poorer outcomes and return-to-play rates after surgical repair.

The purpose of this study was to determine outcome scores and return to play of throwing athletes treated with arthroscopic capsulolabral repair for posterior shoulder instability with coexistent RCTs and to compare them with outcome scores as well as return to play of throwing athletes with isolated posterior shoulder instability. It was hypothesized that throwing athletes with a combination of posterior shoulder instability and RCT would have poorer outcomes and poorer return to play after surgery.

Methods

Patient Selection

After Institutional Review Board approval, informed consent was obtained, and consecutive throwing athletes who underwent arthroscopic posterior capsulolabral reconstruction for posterior shoulder instability were followed in the perioperative period. Inclusion criteria were throwing athletes participating in competitive sports at the high school, collegiate, or professional level, minimum 1-year follow-up, presence of unidirectional posterior instability, and absence of symptoms of instability in any direction other than posterior. Patients with inferior instability, SLAP pathology on examination and on magnetic resonance imaging, multidirectional instability, or habitual or psychogenic voluntary shoulder subluxations were excluded. Patients with diagnoses of both posterior shoulder instability and impingement treated with subacromial decompression and distal clavicle resection were also excluded.

After this cohort was identified, patient records were reviewed for pertinent operative data, such as procedure, complications, and evidence of RCT by operative report and arthroscopic photographs. A partial RCT was defined as a tear of 10% to 50%; those with rotator cuff fraying were determined not to be significant.

Patient Evaluation

Surgeries were performed between January 1998 and December 2009 by the senior author (JPB). All patients were followed with clinical examinations, radiographs, and subjective grading scales. Recorded patient demographic data included age, sex, sport, position, competition level, and follow-up duration.

All patients had symptomatic posterior shoulder instability, including posterior shoulder pain, clicking, a sensation of subluxation, or instability/apprehension with motion. Each athlete’s shoulder was palpated for tenderness and tested for impingement. Specific posterior glenohumeral instability tests, including the Kim test, the circumduction test, the jerk test, the posterior load-and-shift test, and the posterior stress test, were performed on all patients. Patients with multidirectional instability on the sulcus test, as well as provocative tests indicating SLAP pathology, such as the Crank test and the active compression test, were not included. Standard radiography and magnetic resonance arthrography (MRA) were performed to further narrow inclusion and exclusion criteria.

Both before surgery and at latest follow-up, patient outcomes were evaluated using the American Shoulder and Elbow Surgeons (ASES) score (range, 0-100) which combines a subjective functional scale measuring activities of daily living (0-3 for each of 10 tasks, with a total of 0-30) and a subjective pain scale (0-10, with 10 being worst pain). Values >80 were described as excellent, and failures were defined as scores <60 after surgery. A
subjective stability scale (0-10, with 0 indicating completely stable and 10 completely unstable), strength scale (0-3, with 0 indicating none, 1 markedly decreased, 2 slightly decreased, and 3 normal), and ROM scale (0-3, with 0 indicating poor, 1 limited, 2 satisfactory, and 3 full) were evaluated both before surgery and at the latest follow-up. A stability score >5 after surgery was defined as a failure. Patients were also asked if, based on their current state, they would undergo surgery again. Intraoperative findings and specific surgical procedures performed were correlated with the aforementioned subjective and objective outcome scores.

**Operative Treatment**

Throwing athletes who met inclusion criteria and failed nonoperative management underwent surgery by the senior author (JPB). Each patient was examined under anesthesia and, with the patient in the lateral decubitus position, a diagnostic arthroscopy was performed to identify posterior capsulolabral complex pathology, including a patulous capsule, capsular tears, labral fraying, and labral tears. A careful examination for rotator cuff pathology was also performed. Based on preoperative clinical examination, MRA, examination under anesthesia, pathologic findings at diagnostic arthroscopic surgery, and surgeon experience, capsulolabral plication was performed with or without suture anchors. After capsulolabral repair, the capsule was evaluated for residual laxity, and additional plication sutures were placed, as indicated, with care to avoid overconstraint in these throwing athletes. Posterior glenohumeral stability restoration was judged by removing traction and performing posterior load-and-shift and posterior stress tests. Any RCT with <50% thickness was débrided. Postoperative care and rehabilitation were carried out as previously described and were not altered by the presence or absence of a RCT.

**Statistical Analysis**

Preoperative and latest follow-up ASES scores, stability scores, functional scores, and pain-level findings were compared using paired-samples Comparisons between groups, including throwing athletes with and without rotator cuff pathology, were done using the Student t test. Outcome comparisons between multiple groups, which included intraoperative findings and surgical fixation methods, were analyzed with c model for nonparametric data. Statistical significance was set at P < .05. A power analysis found that this study was able to detect a meaningful difference of 10 ASES points.

**Results**

**Patient Demographic Characteristics**

Of the 56 throwing athletes who met the inclusion criteria, 24 were found to have rotator cuff pathology in addition to posterior capsulolabral pathology, while 32 were found to have capsulolabral pathology alone. Demographic data are listed in Table 1. Mean age was 20.1 years for patients with rotator cuff pathology and 17.8 years for patients without RCTs. All 24 athletes with rotator cuff pathology were treated with arthroscopic débridement. Mean follow-up was 38.6 months (range, 16.5-63.6 months) for patients with RCTs and 39.1 months (range, 12.98.8 months) for patients without RCTs. No significant difference was found in age, sports level, or follow-up between groups.

**Outcomes**

Table 2 lists the preoperative and postoperative scores for shoulder performance in throwing athletes with
posterior shoulder instability, with and without RCTs.

**ASES Scores.** Mean preoperative ASES scores for patients with RCTs improved significantly ($t = -13.8, P < .001$), as did those for patients without rotator cuff pathology ($t = -8.9, P < .001$). No significant differences in ASES score were found between patients with and without rotator cuff pathology before or after surgery ($t = 1.9, P = .07; t = .58, P = .06$). In addition, 70.8% (17/24) of throwing athletes with rotator cuff pathology had an excellent postoperative outcome (ASES score >80), and 29.2% (7/24) had a satisfactory outcome (ASES score, 60-80). Thus, 100% of those with concomitant posterior shoulder instability and RCTs had a good or excellent outcome after surgical intervention. In those without rotator cuff pathology, 78.1% (25/32) had an excellent outcome, 12.5% (4/32) had a satisfactory outcome, and 9.4% (3/32) had a poor outcome. Thus, 91% of those without rotator cuff pathology had a good or excellent outcome after surgery.

**Stability.** Preoperative stability scores improved significantly after surgery in both groups ($t = 7.2, P < .001; t = 10.5, P < .001$). There were no statistical differences between preoperative or postoperative stability scores in those with or without rotator cuff pathology ($t = 1.7, P = .095; t = .03, P = .975$). Of throwing athletes with RCTs, 54.2% (13/24) had an excellent outcome, 33.3% (8/24) a good outcome, and 12.5% (3/24) a satisfactory outcome. Thus, 87.5% (21/24) of those with RCTs had a good or excellent outcome in terms of stability. In those without rotator cuff pathology, 46.9% (15/32) had excellent stability, 46.9% (15/32) had good stability, and 3.1% (1/32) had satisfactory stability after surgery. Thus, 93.8% (30/32) of throwing athletes without rotator cuff pathology had good or excellent stability after surgery.

**Pain.** Mean preoperative pain scores for those with and without rotator cuff pathology improved significantly ($t = 13.4, P < .001; t = 7.1, P < .001$). There was no statistical difference in preoperative or postoperative pain scores between those with and without rotator cuff pathology ($t = 1.99, P = .051; t = .49, P = .627$).

**Function.** Mean preoperative function scores for both groups improved significantly ($t = 7.7, P < .001; t = 8.0, P < .001$). There was no difference in improvement in functional scores between the two groups before or after surgery ($t = .36, P = .721; t = .5, P = .622$).

**ROM.** Of those with rotator cuff pathology, 54% (13/24) had normal ROM, 42% (10/24) had satisfactory ROM, and 4% (1/24) had limited ROM. In throwing athletes without rotator cuff pathology, 34% (11/32) had normal ROM, 53.1% (17/32) had satisfactory ROM, and 9% (3/32) had limited ROM after surgery. There was no significant difference in ROM between the groups ($c^2 = 2.7, P = .260$).

**Strength.** Of those with RCTs, 67% (16/24) reported normal strength, 29% (7/24) slightly decreased strength, and 4% (1/24) markedly decreased strength. Of those throwing athletes without rotator cuff pathology, 50% (16/32) had normal strength, 41% (13/32) had slightly decreased strength, and 9% (3/32) had markedly decreased strength. No statistical difference was noted between the two groups ($c^2 = 1.7, P = .429$).

**Return to Sport.** Of those with RCTs, 92% (22/24) returned to sport while 84% (27/32) of throwing athletes without RCTs returned to sport. There was no difference between the two groups ($c^2 = .667, P = .414$). Sixty-seven percent (16/24) of those with RCTs and 56% (18/32) of those without RCTs returned to the same level of sport. No statistical difference was found in return to play between throwing athletes with and without rotator cuff pathology ($c^2 = .624, P = .430$).

**Failures.** According to ASES scores, no throwers with RCTs failed, while 9.4% (3/32) with posterior instability alone failed. Regarding stability, 8.3% (2/24) of athletes with RCTs failed, while 6.3% (2/32) with posterior instability alone failed.
Surgical Findings and Procedures

Of the 24 throwing athletes with rotator cuff pathology, 92% (22/24) had labral tears, while 78% (25/32) of those without RCTs had labral tears. The majority of RCTs were in the posterior supraspinatus and anterior infraspinatus regions. This was not significantly different between groups ($c^2 = 1.86, P = .172$). All labral pathology was posterior-inferior, and all RCTs were <50% thickness, and therefore were débrided. Fifty-four percent (13/24) of those with RCTs had a patulous capsule and 63% (20/32) of throwing athletes without rotator cuff pathology had a patulous capsule. There was no significant difference between groups ($c^2 = .393, P = .530$). Of those with RCTs, 92% (22/24) had surgical fixation with anchors, while 78% (25/32) of those without rotator cuff pathology underwent repair with anchor fixation. There was no statistically significant difference in anchor use between groups ($c^2 = 1.86, P = .172$).

Discussion

Throwing athletes with and without RCTs had similar rates of recovery and return to play after arthroscopic capsular labral repair, with rotator cuff débridement if a tear was present. The mean follow-up was 3.2 years. Further, there was no difference in return to play (92% vs 84%), ASES score, stability, pain, function, ROM, or strength between the 2 groups before or after surgery. In this cohort of 56 patients, 24 throwing athletes (43%) were found to have RCTs.

Return-to-play rates showed no between-group differences; 92% (22/24) of athletes with concomitant RCTs returned to sport, and 67% (16/24) returned to the same level. Eight percent of throwing athletes with RCTs were unable to return to sport after surgery. These return-to-play rates are an improvement over most previously reported rates in throwing athletes and in posterior shoulder instability in general.\textsuperscript{1,4,11} When these athletes are compared with their counterparts with combined SLAP tears and RCTs, return-to-play rates are notably higher. There may be discrepancies in interpreting return-to-play between the two studies, but in the current study, 67% of those with concomitant RCTs achieved return to preinjury level of play. This is 10% higher than the rate reported in athletes with SLAP tears alone (57%) and even higher than in those with concomitant SLAP and RCTs. It is also essential to note that a number of this cohort’s athletes who did not return to play did so for factors (eg, graduation) unrelated to the shoulder. However, the study by Neri and colleagues\textsuperscript{5} included professional athletes who likely all attempted to return to play and, if unable to perform at the same level, likely were unable to continue their professional career.\textsuperscript{5}

All patients with RCTs had a good or excellent outcome (ASES score), and 70.8% had an excellent outcome. Similarly, 97% of those without rotator cuff pathology had a good or excellent outcome, and 81.3% had an excellent outcome. There was no significant difference between the two groups. These results parallel those of Neri and colleagues\textsuperscript{5} study of SLAP tears with RCTs, where 96% (22/23) of throwing athletes had a good or excellent outcome. Despite these high outcome scores in patients with SLAP tears, only 57% were able to return to elite pitching.\textsuperscript{5} In the current study, pain was slightly higher for those with rotator cuff pathology before surgery—a finding consistent with pain frequently being found in patients with isolated partial-thickness RCTs. Their postoperative pain scores were actually lower on average than those of patients without RCTs, which suggests simple débridement of undersurface tears adequately addressed the pathology. The authors theorize that the main pain generator in this population may be posterior instability, and that the rotator cuff has less of an influence. In the SLAP population, the main pain generator likely is the RCT.

Failures by ASES score or strength were fairly rare in this cohort. Many patients opted to have revision surgery because of continued instability, pain, decreased function, or reinjury. One potential cause of failure in this cohort
is inadequate capsular shift. However, capsular plication in throwing athletes is difficult to address, as overtensioning the repair can lead to the inability to adequately perform overhead activities.\(^3,4\) This cannot be overemphasized, particularly with pitchers.

Partial-thickness RCTs, particularly those on the articular side, are common in throwing athletes because of high tensile and compressive loads.\(^12\) Despite the known risk of RCTs with posterior shoulder instability in throwing athletes, the authors are unaware of reports of the incidence or treatment of this pathology. RCTs in this posterior instability group likely represent a pathology other than internal impingement. The high proportion of throwing athletes with RCTs in this study (43%) indicates a need for close evaluation of rotator cuff pathology in young throwing athletes. Ide et al found that 75% of patients with SLAP tears had partial articular-sided RCTs.\(^13\) In the current study, all RCTs were small partial tears, and arthroscopic débridement was performed. It is unknown whether repair of these RCTs would impact return to play. However, rotator cuff repair in this population has been shown to have poor outcomes. Tear thickness typically is used to determine treatment, with débridement performed if <50% tendon thickness is affected. More recently, many have advocated having greater tendon involvement in throwers before repair, because of poor outcomes. Although studies are limited, tear size does seem to correlate with outcomes.\(^14\)

**Study Limitations**

Limitations of this study include its small number of professional throwing athletes, with the majority being high school athletes. Further, although ASES scores are consistently used in posterior shoulder instability studies, these scores are influenced highly by pain scores, and some argue that other scoring systems may provide more useful information. However, none of the more modern scoring systems have been studied extensively in posterior glenohumeral instability. Further, because the authors used the present scoring systems previously,\(^1-4\) they were continued to be used for comparison and consistency. Outcomes such as ROM and strength may carry more weight if measured and documented by clinical examination. Further testing, such as clinical evaluation of the jerk test or the posterior load-and-shift test, and their comparison before and after surgery may provide more objective data.

**Conclusion**

Arthroscopic capsulolabral reconstruction is successful in throwing athletes with RCTs treated with arthroscopic débridement. Unlike a previous study of throwing athletes’ outcomes after surgery for concomitant SLAP tears and RCTs,\(^5\) this study of throwing athletes with concomitant posterior shoulder instability and RCTs found no difference in patient-reported outcome measures or return to play. In throwing athletes with posterior instability and RCTs, arthroscopic posterior capsulolabral repair with rotator cuff débridement is successful.

**Key Info**
Figures / Tables:

Table 1. Demographic Data for Athletes With Posterior Instability With and Without Rotator Cuff Tears (N = 56 Shoulders)

<table>
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<tr>
<th>Characteristic</th>
<th>Rotator Cuff Tears</th>
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*The majority of athletes were males in high school and their mean follow-up was 3 years.*

Table 2. Preoperative and Postoperative Scores for Shoulder Performance in Throwing Athletes With Posterior Shoulder Instability With and Without Rotator Cuff Tears

<table>
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<tr>
<th>Outcome Measure</th>
<th>With Rotator Cuff Tears (n=24 shoulders)</th>
<th>Without Rotator Cuff Tears (n=32 shoulders)</th>
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<td>Mean Score</td>
<td>Range</td>
<td>Mean Score</td>
<td>Range</td>
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<td>20-70</td>
<td>85.4</td>
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<tr>
<td>Stability</td>
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<td>2.4</td>
<td>0-6</td>
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<td>Function</td>
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<td>0-30 0 = worst</td>
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</table>
There was no difference in ASES, stability, pain, or functional scores between athletes with posterior instability alone compared with patients with concomitant rotator cuff tears.

Abbreviation: ASES, American Shoulder and Elbow Surgeons.

References


**Multimedia**

**Product Guide**

- BioComposite SwiveLock Anchor
- BioComposite SwiveLock C, with White/Black TigerTape™ Loop
- BioComposite SwiveLock Anchor, With Blue FiberTape Loop
- Knotless SutureTak® Anchor

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