Outcomes of Arthroscopic Bankart Repair in Collision Versus Noncollision Athletes

Massimo Petrera, MD; Tim Dwyer, MD; Matthew R. S. Tsuji, MD; John S. Theodoropoulos, MD

The purpose of the study was to compare the recurrence rate of arthroscopic Bankart repair with suture anchors in collision vs noncollision athletes. Sixty-four patients who underwent arthroscopic shoulder stabilization using suture anchors for recurrent anterior dislocation were identified. Forty-three patients (22 collision and 21 noncollision) were evaluated at a minimum 24-month follow-up. The recurrence rate was reported, and functional outcomes (American Shoulder and Elbow Society, Western Ontario Shoulder Index, and Short Form 12) were evaluated. Statistical analysis was performed using chi-square test and Student’s t test with a 95% confidence interval and a significance level set at a P value less than .05. The overall dislocation recurrence rate was 4.6% (2 of 43 patients); the dislocation recurrence rate in collision athletes was 9% (2 of 22 patients), and no redislocations occurred in noncollision athletes. No statistical differences existed in Western Ontario Shoulder Index score (73.5% in collision and 73.4% in noncollision athletes; P = .831), American Shoulder and Elbow Society score (91.2 in collision and 80.7 in noncollision athletes; P = .228), and Short Form 12 score (108.5 in collision and 101.2 in noncollision athletes; P = .083). Average external rotation loss was 6.8° in collision and 5.5° in noncollision athletes (P = .864). Ninety percent of collision athletes vs 95% of noncollision athletes were satisfied. Seventy-three percent of collision and 81% of noncollision athletes were able to return to sport at their preinjury levels. Collision athletes had higher recurrence rates after arthroscopic shoulder stabilization compared with noncollision athletes, but no statistical difference was found. Functional outcomes according to American Shoulder and Elbow Society, Western Ontario Shoulder Index, and Short Form 12 were similar.

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It has traditionally been accepted that open repair of the anteroinferior labrum (Bankart lesion) results in a lower redislocation rate than arthroscopic repair.\(^1\)\(^2\) Although recent randomized trials have reported comparable outcomes between open and arthroscopic stabilization procedures,\(^3\)\(^4\) meta-analyses have reported conflicting results. Meta-analyses by Petreira et al\(^5\) and Hobby et al\(^6\) reported comparable outcomes between the 2 surgical methods, whereas Mothadi et al\(^7\) and Lenders et al\(^8\) reported more favorable outcomes with open rather than arthroscopic labral repair.

Regarding athletes involved in collision sports, it has been reported that recurrence rates following shoulder stabilization surgery are higher compared with noncollision athletes.\(^9\)\(^10\)\(^11\)\(^12\) Therefore, open repair is considered the gold standard treatment for recurrent shoulder instability in this population.\(^1\)\(^10\)\(^11\)\(^12\) Studies have reported improved results following arthroscopic stabilization procedures, with recurrence rates approaching those of open repair.\(^13\)\(^14\) This improvement may be due to a better understanding and assessment of concomitant lesions (capsular laxity, bone loss, inferior glenohumeral ligament avulsion), more clearly defined indications for arthroscopic stabilization, and improvements in arthroscopic techniques and instrumentation.\(^13\)\(^14\) The addition of arthroscopic capsular plication to labral repair may also improve recurrence rates in high-risk patients.\(^14\)

Several possible advantages of arthroscopic stabilization exist in athletes, including the preservation of the subscapularis tendon and reduction in postoperative pain.\(^15\)\(^16\) Current literature evaluating the outcome of arthroscopic stabilization in high-risk athletes consists of studies in which labral repair is performed in conjunction with additional procedures, including rotator interval closure, thermal treatment, and capsular plication.\(^9\)\(^13\)\(^14\)\(^17\)

The outcome of the isolated arthroscopic labral repair in collision athletes is unknown. The authors hypothesized that arthroscopic repair performed without capsular plication would produce similar recurrence rates and clinical outcomes in collision and noncollision athletes.

**MATERIALS AND METHODS**

The authors received institutional research ethics board approval. A retrospective cohort study was performed, and a chart review identified all patients who underwent arthroscopic shoulder stabilization surgery between December 2005 and April 2008 at the authors’ institution. The authors only included athletically active patients (recreational, college/school team, and professional) with a preoperative diagnosis of recurrent traumatic anterior instability and an arthroscopic finding of a Bankart lesion. Exclusion criteria were significant bone loss (loss of more than 25% of the anteroinferior glenoid using the intraoperative method reported by Burkhart et al\(^18\) and Burkhart and De Beer\(^19\) or the presence of an engaging Hill-Sachs lesion\(^20\)), a humeral avulsion of the glenohumeral ligament lesion, a concomitant rotator cuff tear, and multidirectional instability (as defined by the presence of a sulcus sign or abnormal translation of the humeral head in all directions). No patients with anterior labral periosteal sleeve avulsion lesions were included. All patients who underwent surgical repair had preoperative magnetic resonance imaging with or without intra-articular contrast medium. Patients with bony lesions were further assessed with computed tomography. Patients were subdivided into the collision group and non-collision group, as per published recommendations (Table 1).\(^21\)

**Surgical Technique**

The senior author (J.T.) performed all surgical repairs in the lateral position using a shoulder distraction device, and standard posterior, anterior, and superior-anterior portals.\(^22\) With the arthroscope in the superior-anterior portal, the anteroinferior capsulolabral complex was mobilized using an arthroscopic elevator, the glenoid rim was abraded using an arthroscopic rasp and high-speed burr (Figure 1), and the repair was performed with single-loaded suture anchors (2.3 mm Bioraptor; Smith & Nephew, Andover, Massachusetts) (Figure 2). If placement of the suture anchor at the 5:30-o’clock position was difficult, a trans-subscapularis tendon percutaneous portal was made 5 to 10 mm below the superior border of the tendon to allow for anchor placement. The number of anchors used varied according to the extent of labral tear, with a minimum of 3. The sutures were shuttled using a 45° suture shuttle (Spectrum II; ConMed Linvatec Inc, Largo, Florida) in a standard way, taking tissue inferior to each anchor (Figure 3). Finally, sutures were tied with a SMC sliding knot backed with alternating half hitches. As all su-

<table>
<thead>
<tr>
<th>Classification of Sports Participation*</th>
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<tbody>
<tr>
<td><strong>Collision</strong> (n=22)</td>
<td><strong>Noncollision</strong> (n=21)</td>
</tr>
<tr>
<td>Hockey (n=13)</td>
<td>Basketball (n=4)</td>
</tr>
<tr>
<td>American football (n=4)</td>
<td>Baseball (n=4)</td>
</tr>
<tr>
<td>Rugby (n=3)</td>
<td>Golf (n=3)</td>
</tr>
<tr>
<td>Soccer (n=1)</td>
<td>Tennis (n=2)</td>
</tr>
<tr>
<td>Martial arts (n=1)</td>
<td>Weight lifting (n=2)</td>
</tr>
<tr>
<td></td>
<td>Swimming (n=2)</td>
</tr>
<tr>
<td></td>
<td>Badminton (n=1)</td>
</tr>
<tr>
<td></td>
<td>Volleyball (n=1)</td>
</tr>
<tr>
<td></td>
<td>Skiing (n=1)</td>
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<tr>
<td></td>
<td>Running (n=1)</td>
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tures were passed inferior to the anchor, the capsulolabral tissue was shifted from inferior to superior, forming a bumper of capsulolabral tissue (Figure 4). No patient underwent rotator interval closure or isolated capsular plication.

**Postoperative Rehabilitation Protocol**

Phase I (immediately postoperative) involved using a sling for 2 weeks and performing pendular exercises but no external rotation or abduction. Phase II (postoperative weeks 5-8) allowed passive and active assisted range of motion (ROM) exercises, with a focus on isotonic strengthening exercises and an avoidance of heavy lifting. Phase III (postoperative weeks 9-16) included an advanced muscle strengthening program progressing to heavier resistance, whereas phase IV (postoperative weeks 17-24) included progressing to an interval sports program. Return to sport was allowed between 4 and 6 months postoperatively according to the following factors: normal deltoid and rotator cuff strength compared with the contralateral side, full pain-free functional ROM, and lack of apprehension on physical examination.

**Outcome Assessment**

One author (M.P.) clinically evaluated all patients at a minimum of 24 months postoperatively. The recurrence rate was the primary endpoint of the study. Bilateral ROM (measured with a goniometer and compared with the contralateral shoulder), functional outcomes according to the American Shoulder and Elbow Society score, Western Ontario Shoulder Index, Short Form 12, including mental and physical component scores, and return to preinjury level of activity were also investigated.

**Statistical Analysis**

Statistical analysis was performed using independent Student’s *t* test with a 95% confidence interval to calculate the differences between the groups in functional outcome and ROM. Chi-square test with a 95% confidence interval was used to calculate the difference between the recurrence rates in the 2 groups. Statistical significance was set at a *P* value less than .05.

**Results**

Forty-three patients were evaluated at a minimum follow-up of 24 months. Patient demographics are shown in Table 2. The overall recurrence rate was 4.6% (2 of 43 patients). Both recurrences occurred in the collision group, which had a recurrence rate of 9% (2 of 22 patients); no recurrences occurred in the noncollision group (0 of 21 patients).

One athlete sustained a redislocation 12 months postoperatively after a violent trauma while playing hockey. This patient subsequently sustained 3 more dislocations and was treated with an open Latarjet procedure. The second failure occurred in a collision athlete who reported a redislocation 3 years postoperatively while playing American football. The mechanism of injury was a forced abduction and external rotation of the arm during a tackle. After a 6-week period rehabilitation period, the athlete returned to play and sustained no other redislocation. One collision athlete and 1 noncollision athlete reported an ill-defined incidence of subjective instability, with a negative apprehension test at final follow-up and no dislocation. Other than redislocation in 2 patients, no intraoperative or postoperative complications were reported in either group.
Average Western Ontario Shoulder Index, American Shoulder and Elbow Society, and Short Form 12 scores are reported in Table 3. Average external rotation loss at 90° of abduction was 6.8° in the collision group and 5.5° in the noncollision group (Figure 5). Ninety-five percent of noncollision athletes and 90% of collision athletes were satisfied with the outcomes of the procedure and had no limitations in activities of daily living. Seventy-three percent of collision athletes returned to their preinjury level of sport, as did 81% of noncollision athletes. With regard to functional outcomes and ROM, statistical analysis revealed no significant difference between collision and noncollision athletes.

**DISCUSSION**

The most important finding in the current study was an increased redislocation rate in collision athletes treated with arthroscopic Bankart repair compared with noncollision athletes. However, this was not statistically significant. Two traumatic dislocations (9%) occurred in the collision group compared with 0 (0%) in the noncollision group.

Open repair has traditionally been considered the gold standard for the treatment of traumatic anterior shoulder instability in collision athletes,\(^1,10-12\) with the advantages mostly related to an ability to restore the capsular tension through capsular plication or an inferior to superior capsular shift.\(^12,23\) As reported by Dickson and Devas\(^2\) and Rowe et al,\(^25\) the recurrence rate with open Bankart repair for all patients with instability ranges between 3.5% and 4%, whereas in the subgroup of patients who participate in collision sports, recurrence rates range between 3% and 30%.\(^10,12,26\) In a study of 58 American football players who underwent open stabilization with suture anchors, Pagnani and Dome\(^22\) reported a 3% subluxation incidence, with no reported redislocations.

Not all studies report such successful outcomes. Uhorchak et al\(^26\) reported a

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**Table 2**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Collision Group</th>
<th>Noncollision Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>22</td>
<td>21</td>
</tr>
<tr>
<td>Mean age (range), y</td>
<td>27.6 (19-45)</td>
<td>32.1 (18-50)</td>
</tr>
<tr>
<td>Mean follow-up (range), y</td>
<td>23 (2-3)</td>
<td>23 (2-2.8)</td>
</tr>
<tr>
<td>Dominant arm involved, No. (%)</td>
<td>12 (54.5)</td>
<td>10 (47.6)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>22</td>
<td>17</td>
</tr>
<tr>
<td>Women</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Athletic level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional</td>
<td>5</td>
<td>4</td>
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<tr>
<td>Recreation</td>
<td>17</td>
<td>17</td>
</tr>
</tbody>
</table>

**Table 3**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Collision Group (n=22)</th>
<th>Noncollision Group (n=21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of recurrences (%)</td>
<td>2 (9)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Average ASES (range), points</td>
<td>91.2 (66.6-100)</td>
<td>80.7 (50-100)</td>
</tr>
<tr>
<td>Average WOSI (range), points</td>
<td>73.5 (35.9-99.2)</td>
<td>73.4 (35.7-100)</td>
</tr>
<tr>
<td>Average SF-12 (range), points</td>
<td>108.5 (78.1-116)</td>
<td>101.2 (60.6-117.4)</td>
</tr>
<tr>
<td>Satisfaction, %</td>
<td>90</td>
<td>95</td>
</tr>
<tr>
<td>Return to sport, %</td>
<td>73</td>
<td>81</td>
</tr>
</tbody>
</table>

Abbreviations: ASES, American Shoulder and Elbow Society; SF-12, Short Form 12; WOSI, Western Ontario Shoulder Index.

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**Figure 5**: Graph showing range of motion (average difference compared with the unaffected side) at a minimum 24-month follow-up. Abbreviation: ABD, abduction.
15% recurrent instability rate with open repair in a group of 53 collision athletes (boxing, football, and rugby), and Roberts et al\textsuperscript{10} reported a 30% recurrence rate in a group of 56 Australian Rules football players.

It has also been reported that an open Latarjet is a reliable treatment for primary shoulder stabilization in collision athletes. Neyton et al\textsuperscript{13} reported no recurrences in a group of 34 rugby players (37 shoulders) treated for anterior shoulder instability. However, the current authors reserve this option for revision cases and patients presenting with a glenoid bone loss greater than 25% or with engaging Hill-Sachs lesions due to the significant complication rate associated with the Latarjet procedure. Shah et al\textsuperscript{17} reported a 10% incidence of neurological injury and a 6% superficial infection rate, and Butt and Charalambous\textsuperscript{18} reported a 10% graft migration or nonunion rate and hardware complications in 6.5% of patients. Furthermore, the prevalence of arthritic changes seen at long-term follow-up (range, 10-20 years) of the Latarjet procedure ranges between 30% and 60%.\textsuperscript{27,30,31} Hovelius et al\textsuperscript{10} reported that 35% of patients had mild and 14% had moderate-to-severe arthropathy at 15-year follow-up, and Allain et al\textsuperscript{11} reported a 62% prevalence of osteoarthritis at 10- to 23-year follow-up.

Recent studies have reported good results with arthroscopic stabilization using suture anchors, with failure rates similar to open repair, and the advantages of reduced postoperative pain, earlier rehabilitation, and improved external rotation.\textsuperscript{3,5,32} In a case series, Bacilla et al\textsuperscript{15} reported a 7% redislocation rate in high-risk athletes after arthroscopic stabilization using suture anchors, whereas Mazzocca et al\textsuperscript{14} reported an 11% redislocation rate. Both authors emphasized that proper anchor placement, concomitant capsular plication, and rotator interval closure in case of persistent inferior laxity were the key to the success of the arthroscopic procedure. Similarly, Larrain et al\textsuperscript{13} reported a recurrence rate of 8% in a group of 121 rugby players with no significant bone loss (glenoid bone loss less than 25%, Hill-Sachs lesions smaller that one-fourth of articular humeral head) treated by an arthroscopic Bankart repair. Only 2 prospective cohort studies comparing the outcomes in collision vs noncollision athletes have been published. Ide et al\textsuperscript{13} reported 55 athletes (21 contact vs 34 noncontact) who underwent arthroscopic stabilization with suture anchors and had a 9% redislocation rate in the contact group vs 6% in the noncontact group. Cho et al\textsuperscript{9} reported a higher recurrent instability rate in the collision group, with a 28.6% postoperative subluxation or dislocation rate compared with 6.7% in the noncollision group. In the latter study, labral repair was performed using suture anchors in 21 patients, tacks in 7, and knotless suture anchors in 1; the higher recurrence rate was related to the assorted fixation techniques.\textsuperscript{5,6}

In the current study, the senior author performed arthroscopic stabilization using suture anchors in both study groups without performing rotator interval closure or capsular plication of the inferior pouch. This treatment method resulted in a recurrence rate of 9% in the collision group. It may be that the recurrences observed in collision athletes (9%) are attributable to high-risk sport activities rather than the arthroscopic technique (which was identical in the 2 groups and performed by a single surgeon). It is well known that sports that include a combination of violent overhead activity and body contact, such as hockey and Australian and American football, have higher failure rates even with open surgical stabilization.\textsuperscript{10,26} In the current study, both failures occurred as a result of high-impact trauma, 1 in a hockey player and 1 in an American football player.

The collision athletes in the current series reported a 72.7% return to sport at preinjury level, which was reduced compared with 80.9% of noncollision athletes. This relatively large proportion of athletes who did not return to preinjury levels may reflect the fact that the majority were recreational participants. All professional athletes in the cohort (5 collision and 4 noncollision athletes) resumed sport at the preinjury level by the end of the study. Cho et al\textsuperscript{9} reported a 21.4% complete return to the preinjury level in collision athletes, with 57% of them returning to the same level with a slight or moderate limitation. Conversely, Ide et al\textsuperscript{13} reported a complete return to the preinjury level in 86% of the contact athletes treated; however, a subanalysis of the return to sports in professional and nonprofessional athletes was not performed in these studies.

The current study was limited due to its retrospective nature, relatively small study population (43 athletes), and relatively short-term follow-up (2 years). With more patients, a statistically significant difference may be seen in the redislocation rate between collision and noncollision athletes. Also, with increased follow-up, the overall redislocation rate may increase in both groups. Performing a rotator interval closure or capsular plication may have reduced the redislocation rate in the collision athletes; however, doing so can risk significant reductions in external rotation. This study is clinically relevant because collision athletes should be counseled regarding the likelihood of a higher surgical failure rate than that seen in athletes pursuing noncollision activities due to the aggressive nature of their sporting activities.

**Conclusion**

The authors found higher recurrence rates after arthroscopic Bankart repair in collision vs noncollision athletes (9% vs 0%, respectively), although this finding was not statistically significant. No statistical significance existed between the 2 groups in functional outcome (Western Ontario Shoulder Index, American Shoulder and Elbow Society, Short Form 12) and ROM. Although arthroscopic Bankart repair is a reliable...
option for collision athletes without significant bone loss, surgeons and athletes should be aware of potentially higher failure rates likely related to the aggressive nature of collision sports. Future studies comparing open and arthroscopic repair in collision athletes are required.

REFERENCES


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