

# Clinical Outcomes and Return to Sport After Arthroscopic Anterior, Posterior, and Combined Shoulder Stabilization

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**Background:** Glenohumeral instability is a common abnormality, especially among athletes. Previous studies have evaluated outcomes after arthroscopic stabilization in patients with anterior or posterior shoulder instability but have not compared outcomes between groups.

**Purpose:** To compare return-to-sport and other patient-reported outcomes in patients after primary arthroscopic anterior, posterior, and combined anterior and posterior shoulder stabilization.

**Study Design:** Cohort study; Level of evidence, 3.

**Methods:** Patients who underwent primary arthroscopic anterior, posterior, or combined anterior and posterior shoulder stabilization were contacted at a minimum 2-year follow-up. Patients completed a survey that consisted of return-to-sport outcomes as well as the Western Ontario Shoulder Instability Index (WOSI), Single Assessment Numeric Evaluation (SANE), American Shoulder and Elbow Surgeons (ASES) score, and Shoulder Activity Scale.

**Results:** A total of 151 patients were successfully contacted (anterior:  $n = 81$ ; posterior:  $n = 22$ ; combined:  $n = 48$ ) at a mean follow-up of 3.6 years. No significant differences were found between the groups with regard to age at the time of surgery or time to follow-up. No significant differences were found between the groups in terms of WOSI (anterior: 76; posterior: 70; combined: 78;  $P = .28$ ), SANE (anterior: 87; posterior: 85; combined: 87;  $P = .79$ ), ASES (anterior: 88; posterior: 83; combined: 91;  $P = .083$ ), or Shoulder Activity Scale (anterior: 12.0; posterior: 12.5; combined: 12.5;  $P = .74$ ) scores. No significant difference was found between the groups in terms of the rate of return to sport (anterior: 73%; posterior: 68%; combined: 75%;  $P = .84$ ).

**Conclusion:** Athletes undergoing arthroscopic stabilization of anterior, posterior, or combined shoulder instability can be expected to share a similar prognosis. High patient-reported outcome scores and moderate to high rates of return to sport were achieved by all groups.

**Keywords:** glenohumeral instability; return to sport; arthroscopic surgery; shoulder stabilization

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Shoulder instability is a common diagnosis in athletes, with glenohumeral dislocations representing nearly 30% of shoulder injuries in adolescent athletes.<sup>25</sup> Glenohumeral dislocations are severe injuries, with nearly 30% of high school and collegiate athletes subsequently undergoing surgery.<sup>14</sup> Among athletes, shoulder instability occurs most frequently in the anterior direction, with posterior shoulder instability (PSI) occurring in just 2% to 10% of instability cases.<sup>4</sup> More recently, however, isolated PSI has been found in 24% of surgically treated patients with shoulder instability in a young military population, with multidirectional instability (MDI) occurring in 18% of patients within this same group.<sup>28</sup>

Anterior<sup>6,15,21</sup> and posterior<sup>15,16</sup> shoulder instability have been associated with a wide variety of sports. Recent studies have demonstrated good results after arthroscopic stabilization of anterior<sup>8,12</sup> and posterior instability.<sup>9,16,27</sup>

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However, there is a lack of comparative data in the literature on clinical outcomes of patients undergoing shoulder stabilization in different directions. The purpose of this study was to compare return-to-sport and other patient-reported outcomes in patients after primary arthroscopic anterior, posterior, and combined anterior and posterior shoulder stabilization. We hypothesized that patients undergoing arthroscopic stabilization of combined shoulder instability would have worse outcomes compared with patients undergoing isolated anterior or posterior stabilization.

## METHODS

Approval for this study was obtained from an institutional review board. Patients who had undergone arthroscopic shoulder stabilization by the senior author (E.C.M.) between December 2005 and November 2013 were retrospectively reviewed. The direction of shoulder stabilization (anterior, posterior, combined) was defined based on operative reports indicating that the patient underwent anterior and/or posterior shoulder stabilization. Patients who underwent capsulolabral repair from 12 to 6 o'clock (right shoulder) or 6 to 12 o'clock (left shoulder) were classified as having undergone anterior shoulder stabilization, and those from 6 to 12 o'clock (right shoulder) or 12 to 6 o'clock (left shoulder) were classified as having undergone posterior shoulder stabilization. Patients with small J-shaped tears around the 6-o'clock position were still classified as having undergone anterior or posterior stabilization, while those with larger tears were classified as having undergone combined anterior and posterior shoulder stabilization.

Indications for surgery included a confirmed labral tear on magnetic resonance imaging in patients with persistent pain and/or limitations in function due to shoulder instability. All patients were prescribed an initial course of physical therapy before deciding on surgical intervention. No intra-articular corticosteroid injections were performed in this cohort in an effort to relieve pain preoperatively.

Patients were excluded from this study if they were not involved in a sport before their injury, if they were older than 50 years of age at the time of surgery, if they underwent open shoulder stabilization with the Latarjet-Bristow procedure, or if they had undergone a revision shoulder stabilization procedure since their primary procedure. Patients were contacted at least 2 years postoperatively and asked to take a survey that included questions on their primary sport before shoulder surgery (including the pre-injury competition level) and their ability to return to sport postoperatively, as well as the Western Ontario Shoulder Instability Index (WOSI),<sup>13</sup> Single Assessment Numeric Evaluation (SANE), American Shoulder and Elbow Surgeons (ASES) score, and Shoulder Activity Scale.<sup>5</sup> Patients who had undergone bilateral shoulder stabilization were asked to fill out the survey twice, once for each shoulder. Survey responses were then divided into 3 groups based on the procedure performed: (1) anterior stabilization, (2) posterior stabilization, and (3) combined anterior and posterior stabilization.

Study data were collected and managed using REDCap (Research Electronic Data Capture) hosted at our institution.<sup>10</sup> REDCap is a secure, web-based application designed to support data capture for research studies, providing (1) an intuitive interface for validated data entry, (2) audit trails for tracking data manipulation and export procedures, (3) automated export procedures for seamless data downloads to common statistical packages, and (4) procedures for importing data from external sources.

## Surgical Technique

The patient was placed in the lateral decubitus position with the arm set in 10 lb of traction using a limb positioner (Arthrex). The anterior and posterior portal sites were injected with 0.25% bupivacaine and 1% lidocaine. Three portals were made: anterosuperior, anteroinferior, and posterior. An accessory posterolateral portal was placed in patients undergoing posterior shoulder stabilization. Capsulolabral repair was performed with JuggerKnot 1.5-mm suture anchors (Biomet).

Portal sites were closed using 3-0 nylon sutures. The joint was injected with 0.25% bupivacaine, 1% lidocaine, and 5 mg of morphine. A sterile dressing was applied, and the patient's arm was placed in a sling.

## Postoperative Rehabilitation

*Anterior Stabilization.* Patients were kept in a sling (UltraSling; DonJoy) with a small abduction pillow for 6 weeks, with physical therapy starting 1 to 2 weeks after surgery. Patients were instructed to start passive and active assisted forward flexion to 90° at 2 weeks postoperatively. At 4 weeks, they were able to start passive and active assisted external rotation to 20°. Active motion was started at 6 weeks. At 8 to 12 weeks, patients were instructed to begin strengthening exercises with bands. By 12 weeks, full range of motion was emphasized with the initiation of some sport-specific exercises. Patients were allowed to return to play at 18 to 24 weeks based on range of motion, strength, and sport-specific ability.

*Posterior Stabilization.* Patients were kept in an external rotation sling (UltraSling ER; DonJoy) for 6 weeks, with physical therapy starting 1 to 2 weeks after surgery. Patients were instructed to start passive and active assisted forward flexion to 90° at 2 weeks postoperatively. At 4 weeks, they were able to start passive and active assisted abduction to 90°. Active motion was started at 6 weeks. At 8 weeks, passive and active assisted internal rotation to 30° was allowed. Unlimited internal rotation was started at 10 weeks. By 14 weeks, patients were allowed to begin sport-specific exercises. Patients were allowed to return to play at 20 to 24 weeks based on range of motion, strength, and sport-specific ability.

*Combined Stabilization.* Patients who underwent combined shoulder stabilization were rehabilitated based on the primary direction of their instability (anterior or posterior) according to the protocols described above.

## Statistical Analysis

One-way analyses of variance were used to compare all continuous outcomes between the 3 groups. Chi-square tests were used to compare preinjury competition levels and all dichotomous variables between the 3 groups.

## RESULTS

From the chosen study period, 289 patients were identified as possible study candidates. Of these, 189 (65%) were successfully contacted for follow-up. Seventeen patients declined to participate, and 21 patients completed the survey but indicated that they were not involved in sports before their injury, leaving 151 patients available for data analysis. Eighty-one patients underwent anterior stabilization, 22 underwent posterior stabilization, and 48 underwent combined anterior and posterior stabilization. Sixty-seven (67/81, 83%) athletes in the anterior stabilization group, 17 (17/22, 77%) athletes in the posterior stabilization group, and 38 (38/48, 79%) athletes in the combined stabilization group reported initially injuring their shoulder while participating in a sport ( $P = .80$ ).

The primary sports in which patients were involved before their injury are listed in Table 1. Overall, the most common sports listed were football, rock climbing, and snowboarding.

Demographic data are provided in Table 2. There were no significant differences between the 3 groups in terms of age at the time of surgery, time to follow-up, number of shoulder instability episodes or closed reductions before surgery, or percentage of patients who injured their dominant shoulder. There was a statistically significant difference in the sex ratios of the 3 groups, with the anterior stabilization group having a lower percentage of male patients compared with the other 2 groups ( $P = .011$ ).

Patient-reported outcome scores are provided in Table 3. There was a trend toward a significant difference in the ASES score between the groups, with the posterior stabilization group scoring lower than the other 2 groups ( $P = .083$ ). Otherwise, no significant differences were found between the groups in terms of the WOSI, SANE, or Shoulder Activity Scale scores.

The preinjury competition level of all included athletes is provided in Table 4. No significant difference was found in the overall distribution of preinjury competition levels between the groups ( $P = .81$ ). Furthermore, no significant differences were found between the groups with regard to the proportion of athletes returning to their sport or preinjury competition level postoperatively or the mean time to return to sport or preinjury competition level after surgery (Table 5). Fear of reinjury, loss of strength, and other life interests were, in order, the most common reasons why patients did not return to their sport. Fear of reinjury, loss of strength, and shoulder pain were, in order, the most common reasons why patients did not return to their preinjury competition level.

## DISCUSSION

Based on the results of this study, patients undergoing arthroscopic stabilization of anterior, posterior, or combined

TABLE 1  
Primary Sport Before Shoulder Stabilization<sup>a</sup>

Sport	Anterior	Posterior	Combined	Total
Football	7	5	11	23
Rock climbing	11	0	2	13
Snowboarding	5	2	5	12
Ice hockey	4	3	3	10
Mountain biking	2	1	7	10
Skiing	6	0	3	9
Volleyball	5	1	2	8
Basketball	5	0	2	7
Rugby	4	1	2	7
Baseball	3	3	0	6
Softball	3	1	1	5
Soccer	4	0	0	4
Swimming	2	1	1	4
Wrestling	1	1	2	4
Martial arts	3	0	0	3
Weightlifting	2	0	1	3
Disc golf	1	0	1	2
Lacrosse	2	0	0	2
Running	2	0	0	2
Skateboarding	2	0	0	2
Tennis	1	0	1	2
Triathlon	1	0	1	2
Ultimate Frisbee	1	0	1	2
Active-duty Army soldier	0	1	0	1
Cheerleading	0	0	1	1
CrossFit	1	0	0	1
Flag football	0	1	0	1
Golf	1	0	0	1
Gymnastics	1	0	0	1
Kayaking	0	1	0	1
Racquetball	1	0	0	1
Track and field	0	0	1	1

<sup>a</sup>Data are presented as No. of patients.

shoulder instability may expect similar results with regard to return to sport and patient-reported outcome scores. Thus, the direction of instability does not seem to play a prognostic role for athletes undergoing arthroscopic shoulder stabilization. Furthermore, despite a moderate rate of return to play (68%-75%), athletes in all groups demonstrated high patient-reported outcome scores (SANE, 85-87; ASES, 83-91). There was a statistical trend toward a lower ASES score among patients in the posterior stabilization group, which approached the reported minimal clinically important difference of this score of 6.4 points.<sup>26</sup>

Shoulder dislocations occur most commonly in the anterior direction, with male adolescents most commonly affected.<sup>17</sup> The authors found a significant difference in the sex proportions between the 3 groups analyzed, with only 73% of patients in the anterior shoulder stabilization group being male compared with 95% and 90% in the posterior and combined stabilization groups, respectively. Song et al<sup>28</sup> found no difference in sex between patients undergoing anterior, posterior, or combined shoulder stabilization, with male patients representing more than 90% of patients within each group. However, their study was performed at a military treatment facility and therefore does

TABLE 2  
Demographic Data<sup>a</sup>

	Anterior	Posterior	Combined	P Value
Age at surgery, y	27.3 ± 8.6 (14-49)	26.6 ± 9.0 (17-45)	28.7 ± 9.0 (15-45)	.55
Time to follow-up, y	3.8 ± 1.4 (2.0-7.1)	3.6 ± 1.1 (2.2-7.4)	3.4 ± 1.2 (2.0-6.3)	.38
No. of shoulder instability episodes	12.1 ± 18.7	15.7 ± 29.7	22.7 ± 49.0	.24
No. of closed reductions	2.6 ± 3.5 (0-20)	0.6 ± 1.7 (0-7)	1.8 ± 7.3 (0-50)	.22
Male sex, n (%)	59/81 (73)	21/22 (95)	43/48 (90)	.011
Dominant shoulder, n (%)	42/81 (52)	12/22 (55)	27/48 (56)	.89

<sup>a</sup>Data are presented as mean ± SD (range) unless otherwise indicated.

TABLE 3  
Patient-Reported Outcome Scores<sup>a</sup>

Measure	Anterior	Posterior	Combined	P Value
WOSI	76 ± 21 (19-100)	70 ± 24 (17-99)	78 ± 19 (23-99)	.28
SANE	87 ± 12 (40-100)	85 ± 15 (50-100)	87 ± 16 (10-100)	.79
ASES	88 ± 15 (26-100)	83 ± 22 (14-100)	91 ± 9 (46-100)	.083
Shoulder Activity Scale	12.0 ± 4.5 (2-20)	12.5 ± 3.2 (6-17)	12.5 ± 3.5 (5-20)	.74

<sup>a</sup>Data are presented as mean ± SD (range). ASES, American Shoulder and Elbow Surgeons; SANE, Single Assessment Numeric Evaluation; WOSI, Western Ontario Shoulder Instability Index.

TABLE 4  
Preinjury Competition Level<sup>a</sup>

Level	Anterior (n = 74)	Posterior (n = 20)	Combined (n = 47)
Professional	1	0	3
Semiprofessional	3	0	1
NCAA: Division I	6	3	5
NCAA: not Division I	11	4	7
Amateur (team or club)	13	3	9
High school	21	7	15
Recreational	19	3	7

<sup>a</sup>Data are presented as No. of patients. Preinjury competition level was available for 141 of 151 patients (93%). NCAA, National Collegiate Athletic Association.

not provide an adequate representation of the general population. Leroux et al<sup>18</sup> studied the epidemiology of patients undergoing primary closed reduction of an anterior shoulder dislocation in Ontario, Canada, and found that 74.3% of all patients included were male, which corroborates the findings of our study.

Given the high incidence of anterior shoulder instability, several studies have examined return-to-sport characteristics after anterior shoulder stabilization.<sup>1,6,22</sup> In a case series of 180 shoulders with anterior-inferior shoulder instability that had undergone arthroscopic stabilization, Aboalata et al<sup>1</sup> assessed patients at a minimum 10-year follow-up. The authors found an overall redislocation rate of 18.18%, with a return to preinjury sport levels in 49.5% of patients.

Two studies<sup>6,22</sup> have specifically compared the outcomes of collision athletes (eg, hockey, football) and noncollision athletes (eg, basketball, baseball, golf) after arthroscopic

anterior shoulder stabilization. At a minimum 24-month follow-up, Petrera et al<sup>22</sup> compared the outcomes of 22 collision athletes and 21 noncollision athletes and found that a return to preinjury levels of sport was achieved by 73% of collision athletes and 81% of noncollision athletes. No significant difference was found between the groups with regard to functional outcome scores (ASES, WOSI, Short Form-12 Health Survey [SF-12]) at follow-up. In a similar study, Cho et al<sup>6</sup> compared the outcomes of collision versus noncollision athletes after arthroscopic anterior shoulder stabilization. At a mean follow-up of 62.1 months, the authors found that a complete return or near-return to the preinjury activity level occurred in 8 of 14 (57%) collision athletes and 11 of 15 (73%) noncollision athletes ( $P < .05$ ). Furthermore, 4 patients in the collision group (28.6%) suffered a postoperative subluxation or dislocation compared with only 1 patient in the noncollision group (6.7%). However, this finding was not statistically significant ( $P = .12$ ).

Although PSI is relatively uncommon, occurring in just 2% to 10% of instability cases,<sup>4</sup> several studies have examined return-to-sport rates and other clinical outcomes after arthroscopic posterior shoulder stabilization. Recently, Katthagen et al<sup>11</sup> compared the outcomes of 20 patients with atraumatic PSI and 12 patients with traumatic PSI, all of whom underwent arthroscopic posterior shoulder stabilization. At a minimum 2-year follow-up, 72% of patients with atraumatic PSI were able to return to sport compared with 90% of patients with traumatic PSI ( $P = .375$ ). In addition, patients with traumatic PSI demonstrated significant improvements in ASES, QuickDASH (short version of the Disabilities of the Arm, Shoulder and Hand score), SANE, and SF-12 Physical Component Summary scores, while patients with atraumatic PSI only demonstrated significant improvements in the ASES score.

TABLE 5  
Return to Sport<sup>a</sup>

Outcome	Anterior	Posterior	Combined	P Value
Returned to sport, n (%)	59/81 (73)	15/22 (68)	36/48 (75)	.84
Time to return to sport, mo	7.7 ± 5.3 (2-24)	8.6 ± 4.4 (3-18)	7.9 ± 5.0 (3-24)	.81
Returned to preinjury competition level, n (%)	40/81 (49)	11/22 (50)	28/48 (58)	.60
Time to return to preinjury competition level, mo	11.7 ± 5.6 (3-24)	11.4 ± 4.2 (6-18)	10.2 ± 5.1 (6-24)	.53

<sup>a</sup>Data are presented as mean ± SD (range) unless otherwise indicated.

Arner et al<sup>2</sup> evaluated 56 consecutive American football players (at the high school, collegiate, and professional levels) who underwent arthroscopic posterior capsulolabral repair with or without suture anchors. At a mean follow-up of 44.7 months, 93% of players were able to return to sport, with 79% returning at the same level of play. The ASES score also improved significantly ( $P < .01$ ). McClincy et al<sup>19</sup> compared the clinical outcomes of overhead-throwing athletes ( $n = 48$ ) with nonthrowing athletes ( $n = 48$ ) after arthroscopic posterior capsulolabral reconstruction and found that 85% of throwers and 88% of nonthrowers returned to sport postoperatively ( $P = .53$ ). Radkowski et al<sup>23</sup> also compared the outcomes of capsulolabral repair between throwing ( $n = 27$ ) and nonthrowing ( $n = 80$ ) athletes. Both groups demonstrated significant improvement in the ASES score at a mean follow-up of 27 months, with no difference between the groups. Throwing athletes were less likely to return to their preinjury level of sport (55%) compared with nonthrowing athletes (71%), although this was not statistically significant ( $P = .16$ ). Finally, DeLong et al<sup>7</sup> performed a systematic review and meta-analysis of clinical outcomes after arthroscopic or open surgery for unidirectional PSI. The authors found that 67.4% of all athletes were able to return to their previous level of sport after the arthroscopic management of PSI and that 91.8% of athletes were able to return to sport at any level.

Based on the studies above, the average rate of return to the preinjury activity level after arthroscopic anterior shoulder stabilization is 50% to 81%, and the average rate of return to sport after arthroscopic posterior shoulder stabilization is 72% to 93%. Both of these ranges are slightly higher than the rates found in the present study (49% and 68%, respectively), despite the high patient-reported outcome scores found in our patient groups. We believe this may be a result of the high prevalence of high school and collegiate athletes included in this study who may no longer have been eligible for competition postoperatively. This is particularly true for athletes involved in sports such as football and ice hockey, which are not often played at the recreational level and therefore would preclude an athlete from returning to sport once he/she has graduated from high school or college unless continuing at the next level of play.

Although a few studies have assessed outcomes after the arthroscopic treatment of MDI,<sup>3,24,29,30</sup> there is significant variation in the definition of MDI,<sup>20</sup> and this diagnosis does not necessarily coincide with concomitant anterior and

posterior instability. To our knowledge, no studies have assessed the outcomes specifically of patients undergoing arthroscopic combined anterior and posterior stabilization, making this the first study to do so.

The strengths of this study include the first comparison of subjective outcomes between patients undergoing arthroscopic shoulder stabilization in different directions. The limitations of this study should also be noted. First, this was a retrospective cohort study, and recall bias may have played a role in some of the survey responses with respect to return to sport. Patients who later underwent a revision procedure were excluded, thereby limiting the results of this study to patients who did not fail shoulder stabilization surgery. In addition, a power analysis was not performed, and therefore, this study may have been underpowered to detect a significant difference between the groups with regard to various outcomes measured. The results of this study are limited to patient-reported outcomes and did not include objective physical examination or imaging findings. Finally, given the variety of sports in which patients were involved before their injury, it is difficult to reach any conclusions about any single sport in particular.

## CONCLUSION

Athletes undergoing arthroscopic stabilization of anterior, posterior, or combined shoulder instability can be expected to share a similar prognosis. High patient-reported outcome scores and moderate to high rates of return to sport were achieved by all groups in this study. Clinical outcomes after arthroscopic shoulder stabilization are likely not affected by the direction of instability.

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