



Return to sport after surgical treatment for posterior shoulder instability: a systematic review

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Purpose: To report the rate of return to sport after surgical treatment for posterior shoulder instability among athletes.

Methods: A systematic review of the literature regarding rate of return to sport after surgical treatment for posterior shoulder instability was undertaken. The primary outcome measure was return to sport. The secondary outcome measures included rate of return to sport to preinjury level, time to return to sport, injury type, reoperations after primary surgery, and objective patient-reported outcome data. Data is summarized with ranges and tables.

Results: A total of 23 studies met inclusion criteria. The rate of return to sport ranged from 57.9%–100%. The rate of return to sport to the preinjury level ranged from 47.4%–100%. Time to return to sport ranged from 4.3–7.7 months. Furthermore, 66% of subjects had an acute traumatic injury and 34% were of insidious onset. The most commonly reported outcome measures were American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form (ASES) scores and visual analog scale (VAS) pain scores. At a minimum of 1-year follow-up, ASES and VAS pain scores improved. Revision rates ranged from 0%–36.8%.

Conclusion: The systematic review demonstrated high rates of return to sport and relatively high rates of return to preinjury level of sport among all athletes who underwent surgical treatment for posterior shoulder instability. Objective patient-reported outcome metrics improved postoperatively whereas revision rates remained low.

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The glenoid labrum is an anatomic structure that provides static stability to the humeral head by deepening the contact area of the glenoid fossa and attaching to glenohumeral ligaments.¹² The glenoid labrum is at risk of injury during contact sports and those that involve overhead throwing motions.^{16,27,32} Although anterior shoulder instability is more common, posterior shoulder instability has been reported at rates as high as 10%.^{8,22} Posterior shoulder instability can cause symptoms such as pain, instability, and subluxation events, which may prevent returning to sports or completing activities of daily living.^{3,24,29,37}

It has been hypothesized that there are 2 patterns of injury, macrotraumatic and microtraumatic.²⁶ Macrotraumatic injuries can occur when a traumatic impact to the joint is directed posteriorly, causing a shearing force to the posterior labrum.²⁵ These acute, traumatic events usually lead to capsulolabral detachment. Microtraumatic injuries can occur in athletes performing repetitive

motions like blocking in football linemen.¹⁴ These axially directed forces stress and stretch on the posterior capsular structures and labrum leading to capsular attenuation and labral tears.^{14,18} Overhead motion can also cause slow, progressive injury from capsular failure. These injuries usually lead to posterior capsule and passive stabilizer laxity.^{31,36}

Surgical treatment can help individuals return to their job, activities of daily living, and sports. There are primary studies regarding postoperative outcomes for surgical treatment of posterior shoulder labral tears and instability.^{6,11,21} However, to our knowledge, there are no published systematic reviews on return to sport (RTS) rates for athletes who undergo surgical treatment for posterior shoulder instability. The purpose of this study is to evaluate the current literature regarding RTS rates in patients who undergo surgical treatment for posterior shoulder instability by systematically identifying and summarizing the evidence on the topic. A secondary purpose is to review and report the immediate and long-term functional outcomes and reoperation rates after surgical treatment. Our hypothesis is that athletes with posterior instability will demonstrate comparable RTS rates to other types of labral tears, have improved functional outcome scores postoperatively, and have low reoperation rates.

This project was reviewed and approved by the Institutional Review Board at the University of Cincinnati.

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Methods

Literature search

This review was accomplished per PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) guidelines. A comprehensive search of online databases was completed on PubMed, Ovid (MEDLINE), Cochrane, and EMBASE databases on May 24, 2019, to identify relevant manuscripts. The following terms were used during the search: “posterior labrum” OR “posterior labral” OR “reverse Bankart” OR “posterior Bankart” OR “posterior shoulder instability” OR “kim lesion” AND “return to sport” OR “return to activity.” No limitations on date range were implemented for this query. Subsequently, the references section of each qualifying article was reviewed to uncover literature that did not populate in the primary search.

Eligibility criteria

Inclusion criteria included full-length literature in the English language that is Level IV evidence or higher and published in peer-reviewed journals. Exclusion criteria included literature reviews, abstract-only reports, expert opinions, case reports, or studies that did not report rate of RTS. The primary search identified 695 articles. The title and/or abstract of all articles were reviewed. Duplicates and nonrelevant articles were screened and removed. This left 28 studies from the primary literature search. In addition, 8 studies were found as references in articles and were included for the full-text review and final analysis.

The authors then examined each of the articles for data reporting on (1) unidirectional posterior shoulder instability; (2) pain associated with a posterior labral tear; (3) RTS; (4) functional outcomes; and (4) revision and reoperation. All the studies needed to have a minimum of 1-year follow-up. In addition, studies on multidirectional shoulder instability and neuromuscular etiologies of shoulder instability were excluded. There was no exclusion or inclusion criterion based on surgical method of treatment. On full-text review of the 36 eligible studies, 23 studies met the inclusion criteria.

Bias assessment

Risk for bias was independently assessed by 2 authors (R.N.M., N.S.S.). The validated Methodological Index for Non-Randomized Studies (MINORS) scoring system was used to evaluate the prevalence of bias in the literature and the methodological quality of all the studies included in this review. If a score could not be determined, the question was discussed between the 2 authors until a consensus was achieved.

Data extraction and analysis

The author, level of evidence, number of athletes, sex, age, duration of clinical follow-up, rate of RTS, rate of RTS at preinjury level, cause of injury, functional outcome scores, and reoperations were extracted from each article. The primary outcome measure was RTS. The secondary outcome measure included functional outcome scores and reoperations after primary surgery. The patient-reported outcomes that were gathered included Shoulder Activity Scale, Western Ontario Instability Index, American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form (ASES) score, Single Assessment Numeric Evaluation, visual analog scale (VAS) pain scores, the Rowe Score for Instability, and the University of California, Los Angeles, Shoulder Rating Score. The 2 outcome metrics with the highest number of reported values were used for analysis.

Because of the study design, there was potential for inclusion of studies that are heterogeneous in clinical and methodological quality. Therefore, we quantitatively explored the heterogeneity through Cochran Q and I^2 values. Cochran Q value was calculated to be 14.29 and 18.07 for RTS rate at any level and RTS to preinjury level, respectively. Both values were less than the critical chi-square value (35.17) and thus suggested that there is homogeneity in the effect sizes of the included studies. I^2 values for both groups were also negative, which by convention is expressed as 0% heterogeneity, and confirmed the Cochran Q value.

Results

Fifteen studies from the primary literature search and 8 additional records identified through other sources produced a total of 23 studies and 1047 patients for this review. They were identified through the method described above (Fig. 1).

MINORS scores are displayed for each manuscript (Table I). The studies included in this review were of 0 Level I, 3 Level II,^{10,3} Level III,^{19,23,28} and 17 Level IV evidence.^{2,3,5,7,11,15,17,20,21,24,25,29,30,33,35,38} The mean patient age was 23.8 years, and 81.9% were male patients. Mean follow-up was 38.1 months (range, 18–66).

All 23 studies reported the RTS rates.^{2,3,5,7,10,11,15,17,19–21,23–25,29–31,33,35,38} The average RTS rate ranged from 57.9%–100% (Table II). The pooled, weighted average for RTS at any level was 86.9% (95% CI: 51.8, 121.9). Twenty-one of the 23 studies reported rates on patients returning to their sport at the same level as they were preinjury.^{2,3,5,7,10,11,15,20,21,23–25,28–31,33,35,38} The results were variable and ranged from 47.4%–100% (Table II). The pooled, weighted average RTS to preinjury levels was 74.9% (95% CI: 42.1%, 107.8%).

Mean time to RTS was reported in 10 studies (range, 4.3–7.6 months).^{2,3,10,15,20,23–25,38} The pattern of injury was reported in 18 as either macrotraumatic (eg, sports collision) or microtraumatic (eg, overuse).^{2,5,7,10,11,15,17,19–21,24,29–31,35,35} In addition, 66.3% of patients had an acute macrotraumatic injury; the remainder were either microtraumatic or unknown in nature. Fifteen of the 23 studies reported reoperation rates (range, 0%–36.8%)^{3,7,10,11,15,19,21,24,28,29,31,35,38} (Table II).

The majority of studies included in our analysis did not stratify RTS rates by sport; however, there were 8 studies that investigated athletes of a particular sport or activity. Four studies investigated athletes who played in contact sports of rugby,¹⁵ football,^{3,25,33} or lacrosse.²⁵ The range of return to preinjury level was from 78.5%–100% in these studies. Two studies looked at throwing athletes and matched them to nonthrowing athletes.^{28,31} Nonthrowers were able to return at rates of 70.3% and 71.8% whereas throwing athletes returned at rates of 60.6% and 55.6%, respectively. Two studies investigated only baseball players. One study considered RTS as returning to baseball²⁰ whereas the other measured return to facing live pitching as a batter.³⁸ The RTS rate was 91.7% for the batting study and 62.5% for return to baseball in the general study (Table II).

At the time of surgery, 18 of the 23 studies excluded patients without recurrent unidirectional instability,^{2,3,5,7,10,11,17,19,21,23,24,28,31,33,35,38} whereas 5 studies included patients without instability but with pain and weakness associated with a posterior labral tear.^{15,23,25,29,30} In these 5 studies, pain was the primary symptom for 25.0%–78.1% of patients. A macrotraumatic incident was still the cause of injury for every patient in 4 of the studies. Badge et al⁴ studied rugby players who had macrotraumatic etiologies of their posterior labral injury and found that 8 of these patients (72.7%) did not have signs of instability. A study that used only baseball players and cited microtraumatic injuries in 25% of cases found that 78% of the athletes had

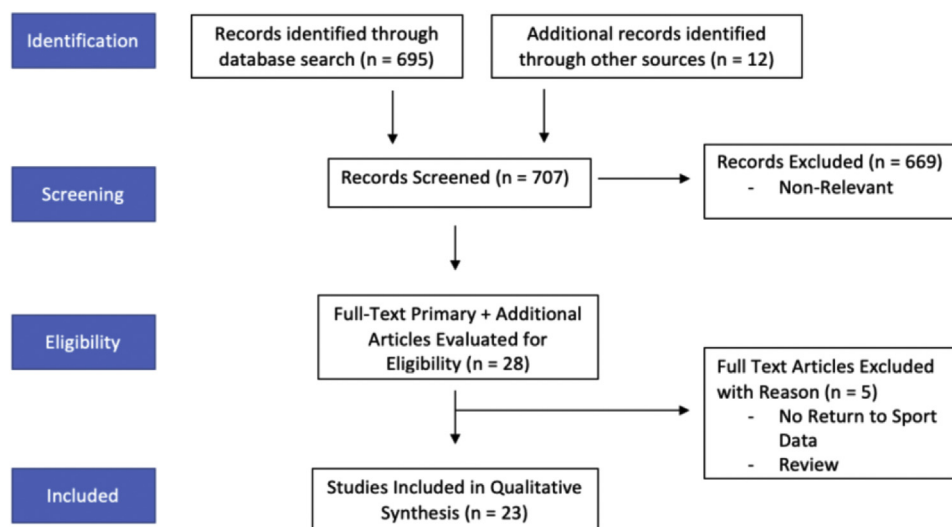


Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram representing study inclusion process.

Table 1
Summary of included studies and patient demographics

Study (first author)	Level of evidence	Year published	MINORS score	Patients, n	Age, yr	Male, n	Mean follow-up, mo
Andrieu ²	IV	2017	10	101	28.7	75	49.6
Arner ³	IV	2015	10	56	17.9	56	44.7
Badge ⁴	IV	2009	10	11	24.8	11	32
Bahk ⁵	IV	2010	10	26	26.3	25	66
Bisson ⁷	IV	2005	9	13	19	8	36
Bradley ⁹	II	2006	12	11	23	77	27.65
Bradley ¹⁰	II	2013	12	183	24.3	135	36
Goubier ¹⁷	IV	2003	8	13	33	7	34
Katthagen ¹⁹	III	2016	10	38	27.6	35	51.6
Kercher ²⁰	IV	2019	9	32	20.5	32	41.58
Kim ²¹	IV	2003	9	27	21	25	39
Kraeutler ²³	III	2018	8	22	26.6	21	43.2
Lenart ²⁴	IV	2012	9	32	21.4	26	35.5
Mair ²⁵	IV	1998	7	9	18.8	9	30
McClincy ²⁸	III	2015	13	96	17.7	68	37
McIntyre ²⁹	IV	1997	10	20	22	15	31
Pennington ³⁰	IV	2010	10	28	21	24	27
Radkowski ³¹	II	2008	8	98	24	75	28
Robins ³³	IV	2017	8	62	—	—	39.6
Schwartz ³⁵	IV	2013	10	18	30	13	35
Wanich ³⁸	IV	2012	10	12	21	21	18
Williams ³⁹	IV	2003	10	26	28.7	26	61
Wolf ⁴⁰	IV	1998	9	14	26	11	33

shoulder instability on examination.²⁰ These data are illustrated in Table II.

Sixteen of the 23 studies reported surgical outcome scores^{2,3,5,10,15,19–21,23,24,28,30,31,35}; however, there was heterogeneity in the type of scoring system used. The 2 most common scores reported were the ASES score and the VAS score. Ten of the 23 studies reported preoperative^{3,10,19,21,24,28,30,31} and 12 of the 23 studies reported postoperative ASES scores.^{3,5,10,19–21,23,24,28,30,31} Preoperative VAS scores ranged from 3.5–5.9, whereas postoperative ASES scores ranged from 0.2–2.39 (Table III, Fig. 2). Preoperative ASES scores ranged from 45.9–67.9, whereas postoperative ASES scores ranged from 83.0–97.6 (Table III, Fig. 3). Six of the 23 studies reported VAS pain scores.^{2,10,20,21,24,30}

Discussion

Awareness of posterior shoulder pathology including instability, labral tears, reverse Bankart and Kim lesions, and its influence on

RTS is increasing, as it affects many athletes.³⁴ In this review, studies were evaluated on the RTS rate after surgical treatment of posterior shoulder instability or pain with posterior labral tear. In addition, we evaluated the rate of RTS to the preinjury level, the injury type, patient-reported outcomes, and reoperation.

Prior systematic reviews on posterior shoulder instability have been performed, but the focus was on patient outcomes data.^{26,36} One of those studies was by Delong et al,¹³ who performed a systematic review on outcomes of posterior shoulder instability. The group also reported data on 561 athletic shoulders for posterior shoulder instability and discovered that 91.8% (standard deviation, 45.43%) RTS at any level of play. In addition, the group found that studies reported 368 of 548 (67.40%; standard deviation, 35.85%) shoulders were able to RTS to the preinjury level.²⁶ Correspondingly, in another study that focused on outcomes of posterior shoulder instability, there were 5 studies that reported a 92.5% RTS rate, and only 2 studies they found reported RTS to preinjury level.³⁶ Our evaluation found a mean RTS of 86.9% (95% CI: 51.8%,

Table II
Return to sport (RTS) data

Study	Patients, n	RTS, n	RTS preinjury level, n	Time to RTS, mo	Prevailing symptom		Macrotrauma, n	Microtrauma, n	Satisfied with surgery, n	Reoperation, n	Study population
					Posterior instability, n	Pain, n					
Andrieu ²	101	81	81	7.6	101	—	79	—	81	—	Football players Rugby players
Arner ³	56	52	44	6	56	—	—	—	50	2	
Badge ⁴	11	11	11	4.3	3	8	11	—	—	0	
Bahk ⁵	29	22	17	—	29	—	24	5	26	—	
Bisson ⁷	13	13	6	—	13	—	11	2	—	1	
Bradley ⁹	100	89	67	6	100	—	53	47	92	8	Baseball players
Bradley ¹⁰	183	180	127	—	183	—	100	—	172	13	
Goubier ¹⁷	13	8	8	—	13	—	9	—	11	—	
Katthagen ¹⁹	38	22	—	—	38	—	20	—	—	2	
Kercher ²⁰	32	30	20	6	7	25	24	8	30	—	
Kim ²¹	27	26	26	—	27	—	27	—	—	0	Contact athletes Matched throwing athletes
Kraeutler ²³	22	15	12	7.7	22	—	—	—	—	—	
Lenart ²⁴	32	32	32	6	32	—	25	—	—	0	
Mair ²⁵	9	9	9	4	5	4	—	—	—	—	
McClincy ²⁸	96	83	63	—	96	—	—	—	—	4	
McIntyre ²⁹	20	17	17	—	15	5	19	—	16	5	Matched throwing athletes Football players Baseball players (batting)
Pennington ³⁰	28	26	23	—	8	20	28	—	26	—	
Radkowski ³¹	107	96	72	—	107	—	53	54	—	8	
Robins ³³	62	55	55	—	62	—	—	—	—	—	
Schwartz ³⁵	19	16	9	—	19	—	12	—	16	7	
Wanich ³⁸	12	11	11	6.5	12	—	—	12	—	0	Baseball players (batting)
Williams ³⁹	26	24	—	6	26	—	26	—	25	2	
Wolf ⁴⁰	14	9	9	—	14	—	6	4	10	1	

Table III
Outcome scores

Study	Preoperative scores		Postoperative scores	
	VAS	ASES	VAS	ASES
Andrieu ²	5.4	—	2.39	—
Arner ³	—	47.4 ± 21	—	87.9 ± 13
Badge ⁴	—	—	—	—
Bahk ⁵	—	—	—	90.7 (53.3–100)
Bisson ⁷	—	—	—	—
Bradley ⁹	5.6 (0–10)	50.4 (14–92)	1.7 (0–7.5)	85.7 (31–100)
Bradley ¹⁰	—	45.9 (2–95)	—	85.1 (33–100)
Goubier ¹⁷	—	—	—	—
Katthagen ¹⁹	—	66.6 (18.3–91.6)	—	97.6 (38.3–99.9)
Kercher ²⁰	4.34	65.4	0.33	96.3
Kim ²¹	4.5 ± 1.8	51.2 ± 10.9	0.2 ± 0.4	96.5 ± 4.7
Kraeutler ²³	—	—	—	83 (46–100)
Lenart ²⁴	3.5 ± 2.1	67.9 ± 15.2	0.8 ± 1.3	93.2 ± 8.9
Mair ²⁵	—	—	—	—
McClincy ²⁸	—	46.6 (3–04)	—	85.2 (25–100)
McIntyre ²⁹	—	—	—	—
Pennington ³⁰	5.9 ± 2.1	44.8 ± 13.5	0.38 ± 0.5	92.5 ± 11.4
Radkowski ³¹	—	50.12	—	85.8
Robins ³³	—	—	—	—
Schwartz ³⁵	—	—	—	—
Wanich ³⁸	—	—	—	—
Williams ³⁹	—	—	—	—
Wolf ⁴⁰	—	—	—	—

VAS, visual analog scale for pain; ASES, American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form.

Data are presented as averages ± standard deviation or (range).

121.9%) after surgical treatment for posterior shoulder instability. Furthermore, our mean RTS to the preinjury level was 74.9% (95% CI: 42.1%, 107.8%). Our results mirror those of systematic reviews on RTS after anterior shoulder instability treatment.¹

Although there are primary data on RTS after reconstruction for posterior shoulder instability, this is the first systematic review dedicated to RTS after reconstruction by analyzing 1047 individuals

from a total of 23 articles. The evidence presented indicates that there are high rates of RTS and relatively high rates of return to preinjury level of sport among all athletes who underwent surgical treatment.

The authors evaluated the heterogeneity in clinical and methodological design between studies. Because the *Q* test does not quantify the extent of heterogeneity, the *I*² index was calculated to provide a percentage of variation between studies. Our calculations resulted in a negative *I*² value for studies reporting on RTS rate at any level and RTS rate to the preinjury level. It is not uncommon to arrive at this value because the sample size may be too small to detect differences between the studies, and as such the authors believe there is insufficient evidence to conclude one way or another whether the studies are truly homogenous enough or not. Identification of heterogeneous results can represent an opportunity to explore the reasons why. Although the results in this study suggest homogenous rates, the authors believe more studies evaluating RTS in patients operatively treated for posterior shoulder instability will increase the available sample size, reduce the risk for a sampling error, and more accurately conclude whether the current body of literature is homogenous.

Although many of the included studies did not report sport-specific return rates, several only examined athletes who participated in 1 sport or activity. Athletes who participated in contact sports (football, rugby) had very high RTS rates when compared with throwing athletes. In addition, baseball players were able to return to the same level of batting ability at a comparable rate to athletes in contact sports but had a much lower RTS rate for returning to baseball in general. These 2 points suggest that overhead activity may be a limiting factor.

Approximately two-thirds of injuries in this study occurred in a traumatic setting such as a collision during a sporting event, whereas the remaining one-third came from chronic repetitive microtrauma in a particular sport or activity. In our review, we found that many of the individuals who had pain with an associated

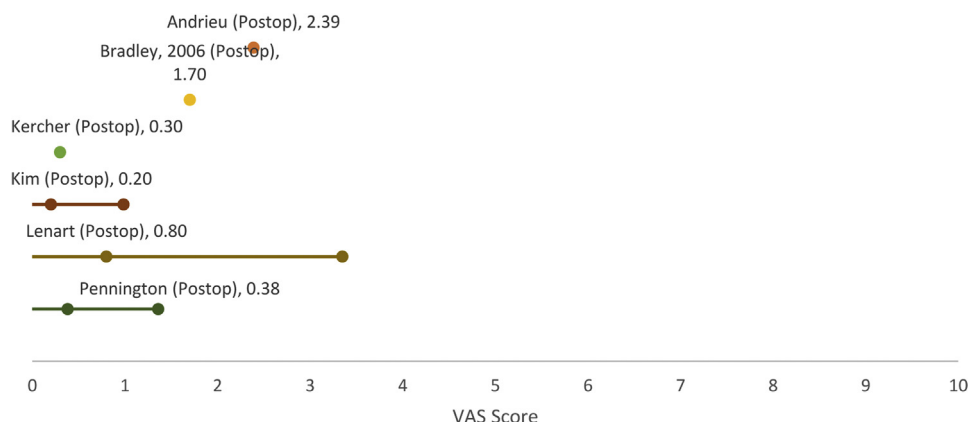


Figure 2 VAS score. Average is shown in data label, lines demonstrate 95% CI if provided. VAS, visual analog scale for pain; CI, confidence interval.

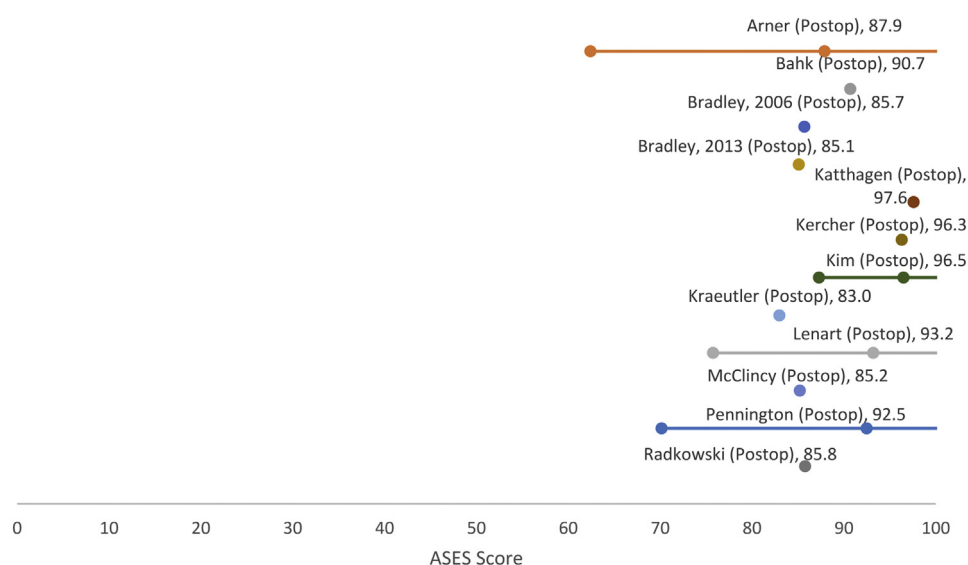


Figure 3 Postoperative ASES scores. Data labels represent average ASES score. 95% CI are indicated with lines when provided. ASES, American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form; CI, confidence interval.

posterior labral tear but did not have instability had macrotraumatic etiologies of their injury. In addition, the studies with microtraumatic etiologies predominating all patients had recurrent posterior dislocation on examination. This may be an artifact of our search criteria and method, but it could also indicate that posterior labral tear symptoms are not uniform based on their cause.

Although the type of functional outcomes score used was heterogeneous, 16 of the 23 studies^{2,3,5,10,15,19–21,23,21,24,30,31,35} reported objective patient reported outcome data. Our study demonstrates that ASES and VAS functional outcome scores improved postoperatively. By using these tools, we were able to determine how similar the included were and increase confidence in our findings.

Limitations

This systematic review poses various limitations, the first being that many of the studies were retrospective in nature. As a result, many of the studies did not report preoperative functional outcome scores. Seventeen of the 23 studies^{2,3,5,7,11,15,17,20,21,24,25,29,30,33,35,38} were Level IV evidence. Also, many of the studies had small sample sizes. When we attempted to make sport-specific conclusions

on our RTS data, we referenced 1 or 2 studies for each sport or activity. To more completely determine the time needed to return to a particular sport and the function an athlete can expect when returning, further review and study must be performed.

We tried to draw conclusions from studies that used similar functional outcome measures; however, there was a large variability in the scoring systems used. In the process of obtaining all the RTS data on posterior shoulder pathology and excluding any that did not, some secondary outcome data from other studies may have been screened out.

There is currently a large heterogeneity in surgical techniques used for addressing shoulder instability. Methods used include capsular shift, posterior capsulolabral reconstruction, posterior glenoid augmentation, glenoplasty, and humeral avulsion of glenohumeral repair. This variety of treatment stems from a lack of consensus on the exact pathobiomechanical lesions that lead to posterior instability.¹⁴ Without an exact pathologic lesion or biomechanical cause, there is no specific surgical treatment that can be chosen.¹⁰ We were unable to make statements about whether a particular surgical method would lead to higher RTS rates because of lack of data about type and degree of pathology in included studies.

Conclusion

The systematic review demonstrated moderate to high rates of RTS and relatively high rates of return to preinjury level of sport among all athletes who underwent surgical treatment for posterior shoulder instability. Outcome metrics improved postoperatively, and there were relatively low rates of revision. This study suggests that surgical treatment for posterior shoulder instability can provide reliable rates of RTS. Although it may vary, clinicians can consider this review data for general guidelines of an athlete's expected ability level when returning to activity.

Disclaimer

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References

- Abdul-Rassoul H, Galvin JW, Curry EJ, Simon J, Li X. Return to sport after surgical treatment for anterior shoulder instability: a systematic review: response. *Am J Sports Med* 2019;47:NP24–7. <https://doi.org/10.1177/0363546519825642>.
- Andrieu K, Barth J, Saffarini M, Clavert P, Godenèche A, Mansat P. Outcomes of capsulolabral reconstruction for posterior shoulder instability. *Rev Chir Orthop Traumatol* 2017;103:S159–63. <https://doi.org/10.1016/j.rcot.2017.08.011>.
- Arner JW, McClincy MP, Bradley JP. Arthroscopic stabilization of posterior shoulder instability is successful in American football players. *Arthroscopy* 2015;31:1466–71. <https://doi.org/10.1016/j.arthro.2015.02.022>.
- Badge R, Tambe A, Funk L. Arthroscopic isolated posterior labral repair in rugby players. *Int J Shoulder Surg* 2009;3:4–7. <https://doi.org/10.4103/0973-6042.50875>.
- Bahk MS, Karzel RP, Snyder SJ. Arthroscopic posterior stabilization and anterior capsular plication for recurrent posterior glenohumeral instability. *Arthroscopy* 2010;26:1172–80. <https://doi.org/10.1016/j.arthro.2010.06.016>.
- Bigliani LU, Pollock RG, McIlveen SJ, Endrizzi DP, Flatow EL. Shift of the posteroinferior aspect of the capsule for recurrent posterior glenohumeral instability. *J Bone Joint Surg Am* 1995;77:1011–20.
- Bisson LJ. Thermal capsulorrhaphy for isolated posterior instability of the glenohumeral joint without labral detachment. *Am J Sports Med* 2005;33:1898–904. <https://doi.org/10.1177/0363546505278258>.
- Blomquist J, Solheim E, Liavaag S, Schroder CP, Espehaug B, Havelin LI. Shoulder instability surgery in Norway. *Acta Orthop* 2012;83:165–70. <https://doi.org/10.3109/17453674.2011.641102>.
- Bradley JP, Baker CL 3rd, Kline AJ, Armfield DR, Chhabra A. Arthroscopic capsulolabral reconstruction for posterior instability of the shoulder: a prospective study of 100 shoulders. *Am J Sports Med* 2006;34:1061–71. <https://doi.org/10.1177/0363546505285585>.
- Bradley JP, McClincy MP, Arner JW, Tejwani SG. Arthroscopic capsulolabral reconstruction for posterior instability of the shoulder: a prospective study of 200 shoulders. *Am J Sports Med* 2013;41:2005–14. <https://doi.org/10.1177/0363546513493599>.
- Cauldwell KL. Arthroscopic capsular plication for shoulder instability. *Athl Ther Today* 1999;4:43–4.
- Cooper DE, Arnoczky SP, O'Brien SJ, Warren RF, DiCarlo E, Allen AA. Anatomy, histology, and vascularity of the glenoid labrum. An anatomical study. *J Bone Joint Surg Am* 1992;74:46–52.
- DeLong JM, Bradley JP. Posterior shoulder instability in the athletic population: variations in assessment, clinical outcomes, and return to sport. *World J Orthop* 2015;6:927–34. <https://doi.org/10.5312/wjo.v6.i11.927>.
- Fronck J, Warren RF, Bowen M. Posterior subluxation of the glenohumeral joint. *J Bone Joint Surg Am* 1989;71:205–16.
- Funk L, Badge R, Tambe A. Arthroscopic isolated posterior labral repair in rugby players. *Int J Shoulder Surg* 2009;3:4. <https://doi.org/10.4103/0973-6042.50875>.
- Glasgow SG, Bruce RA, Yacobucci GN, Torg JS. Arthroscopic resection of glenoid labral tears in the athlete: A report of 29 cases. *Arthroscopy* 1992;8:48–54.
- Goubier JN, Iserin A, Duranthon LD, Vandenbussche E, Augereau B. A 4-port arthroscopic stabilization in posterior shoulder instability. *J Shoulder Elbow Surg* 2003;12:337–41. [https://doi.org/10.1016/S1058-2746\(03\)00039-9](https://doi.org/10.1016/S1058-2746(03)00039-9).
- Hinojosa JF, Fery A, Schmitt D, Sommelet J. Recurrent posterior instability of the shoulder. *Int Surg* 1989;74:257–60.
- Katthagen JC, Tahal DS, Montgomery SR, Horan MP, Millett PJ. Association of traumatic and atraumatic posterior shoulder instability with glenoid retroversion and outcomes after arthroscopic capsulolabral repair. *Arthroscopy* 2017;33:284–90. <https://doi.org/10.1016/j.arthro.2016.07.020>.
- Kercher JS, Runner RP, McCarthy TP, Duralde XA. Posterior labral repairs of the shoulder among baseball players: results and outcomes with minimum 2-year follow-up. *Am J Sports Med* 2019;47:1687–93. <https://doi.org/10.1177/0363546519843070>.
- Kim SH, Ha KI, Park JH, Kim YM, Lee YS, Lee JY, et al. Arthroscopic posterior labral repair and capsular shift for traumatic unidirectional recurrent posterior subluxation of the shoulder. *J Bone Joint Surg Am* 2003;85:1479–87. <https://doi.org/10.2106/00004623-200308000-00008>.
- Kowalsky MS, Levine WN. Traumatic posterior glenohumeral dislocation: classification, pathoanatomy, diagnosis, and treatment. *Orthop Clin North Am* 2008;39:519–33. <https://doi.org/10.1016/j.jocl.2008.05.008>.
- Kraeutler MJ, Aberle NS, Brown CC, Ptasiński JJ, McCarty EC. Clinical outcomes and return to sport after arthroscopic anterior, posterior, and combined shoulder stabilization. *Orthop J Sports Med* 2018;6. <https://doi.org/10.1177/2325967118763754>.
- Lenart BA, Sherman SL, Mall NA, Gochanour E, Twigg SL, Nicholson GP. Arthroscopic repair for posterior shoulder instability. *Arthroscopy* 2012;28:1337–43. <https://doi.org/10.1016/j.arthro.2012.03.011>.
- Mair SD, Zarzour R, Speer KP. Posterior labral injury in contact athletes. *Am J Sports Med* 1998;26:753–8.
- Marion B, Thès A, Hardy P. Posterior instability of the shoulder. In: Imhoff A, Savoie III F, editors. *Shoulder Instability Across the Life Span*. Berlin: Springer; 2017. p. 143–68. https://doi.org/10.1007/978-3-662-54077-0_18.
- Martin DR, Garth WP. Results of arthroscopic debridement of glenoid labral tears. *Am J Sports Med* 1995;23:447–51.
- McClincy MP, Arner JW, Bradley JP. Posterior shoulder instability in throwing athletes: a case-matched comparison of throwers and non-throwers. *Arthroscopy* 2015;31:1041–51. <https://doi.org/10.1016/j.arthro.2015.01.016>.
- McIntyre LF, Caspari RB, Savoie FH. The arthroscopic treatment of multidirectional shoulder instability: two-year results of a multiple suture technique. *Arthroscopy* 1997;13:418–25.
- Pennington WT, Sytsma MA, Gibbons DJ, Bartz BA, Dodd M, Daun J, et al. Arthroscopic posterior labral repair in athletes: outcome analysis at 2-year follow-up. *Arthroscopy* 2010;26:1162–71. <https://doi.org/10.1016/j.arthro.2010.01.006>.
- Radkowski CA, Chhabra A, Baker CL, Tejwani SG, Bradley JP. Arthroscopic capsulolabral repair for posterior shoulder instability in throwing athletes compared with nonthrowing athletes. *Am J Sports Med* 2008;36:693–9. <https://doi.org/10.1177/0363546508314426>.
- Rangavajjula A, Hyatt A, Raneses E, McCrossin J, Cohen S, DeLuca P. Return to play after treatment of shoulder labral tears in professional hockey players. *Phys Sportsmed* 2016;44:119–25. <https://doi.org/10.1080/00913847.2016.1168688>.
- Robins RJ, Daruwalla JH, Gamradt SC, McCarty EC, Dragoo JL, Hancock RE, et al. Return to play after shoulder instability surgery in National Collegiate Athletic Association Division I intercollegiate football athletes. *Am J Sports Med* 2017;45:2329–35. <https://doi.org/10.1177/0363546517705635>.
- Savoie FH, Holt MS, Field LD, Ramsey JR. Arthroscopic management of posterior instability: evolution of technique and results. *Arthroscopy* 2008;24:389–96. <https://doi.org/10.1016/j.arthro.2007.11.004>.
- Schwartz DG, Goebel S, Piper K, Kordasiewicz B, Boyle S, Lafosse L. Arthroscopic posterior bone block augmentation in posterior shoulder instability. *J Shoulder Elbow Surg* 2013;22:1092–101. <https://doi.org/10.1016/j.jse.2012.09.011>.
- Tjoumakaris FP, Bradley JP. Arthroscopic treatment of posterior shoulder instability. *Oper Tech Sports Med Surg* 2012;31:18–23.
- Van Tongel A, Karelse A, Berghs B, Verdonk R, De Wilde L. Posterior shoulder instability: current concepts review. *Knee Surg Sports Traumatol Arthrosc* 2011;19:1547–53. <https://doi.org/10.1007/s00167-010-1293-z>.
- Wanich T, Dines J, Dines D, Gambardella RA, Yocum LA. "Batter's shoulder": can athletes return to play at the same level after operative treatment? *Clin Orthop Relat Res* 2012;470:1565–70. <https://doi.org/10.1007/s11999-012-2264-0>.
- Williams RJ 3rd, Strickland S, Cohen M, Altchek DW, Warren RF. Arthroscopic repair for traumatic posterior shoulder instability. *Am J Sports Med* 2003;31:203–9. <https://doi.org/10.1177/03635465030310020801>.
- Wolf EM, Eakin CL. Arthroscopic capsular plication for posterior shoulder instability. *Arthroscopy* 1998;14:153–63. [https://doi.org/10.1016/s0749-8063\(98\)70034-9](https://doi.org/10.1016/s0749-8063(98)70034-9).