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

Robert N. Matar, MD *, Nihar S. Shah, BS, Tyler J. Gardner, MD, Brian M. Grawe, MD
Department of Orthopaedics and Sports Medicine, University of Cincinnati, Cincinnati, OH, USA

Keywords: Posterior shoulder instability return to sport labral repair overhead sports contact sports ASES score

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.

© 2020 Published by Elsevier Inc. on behalf of American Shoulder and Elbow Surgeons. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

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. The glenoid labrum is at risk of injury during contact sports and those that involve overhead throwing motions. Although anterior shoulder instability is more common, posterior shoulder instability has been reported at rates as high as 10%. 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.

It has been hypothesized that there are 2 patterns of injury, macrotraumatic and microtraumatic. Macrotraumatic injuries can occur when a traumatic impact to the joint is directed posteriorly, causing a shearing force to the posterior labrum. These acute, traumatic events usually lead to capsulolabral detachment. Microtraumatic injuries can occur in athletes performing repetitive motions like blocking in football linemen. These axially directed forces stress and stretch on the posterior capsular structures and labrum leading to capsular attenuation and labral tears. Overhead motion can also cause slow, progressive injury from capsular failure. These injuries usually lead to posterior capsule and passive stabilizer laxity.

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. 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. 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 shoulder instability will demonstrate comparable RTS rates to other types of labral tears, have improved functional outcome scores postoperatively, and have low reoperation rates.
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; (2) RTS; (3) 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 Cochrane Q and I² values. Cochrane 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. I² values for both groups were also negative, which by convention is expressed as 0% heterogeneity, and confirmed the Cochrane 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, 3 Level III, 6 Level IV, and 17 Level IV evidence. 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. The RTS rates 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. The RTS rates 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). The pattern of injury was reported in 18 as either macrotraumatic (eg, sports collision) or microtraumatic (eg, overuse).

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. The remaining studies were either microtraumatic or unknown in nature. Fifteen of the 23 studies reported reoperation rates (range, 0%-36.8%).

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, football, basketball, or lacrosse. 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. 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 baseball whereas the other measured return to any sport.

At the time of surgery, 18 of the 23 studies excluded patients with recurrent unidirectional instability. Whereas 5 studies included patients without instability but with pain and weakness associated with a posterior labral tear. 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 al 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...
shoulder instability on examination. These data are illustrated in Table II.

Sixteen of the 23 studies reported surgical outcome scores; 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 and 12 of the 23 studies reported postoperative ASES scores. 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.

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. 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. One of those studies was by Delong et al, 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. 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. Our evaluation found a mean RTS of 86.9% (95% CI: 51.8%, 91.5%).

Table I
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 |
|---------------------|-------------------|----------------|--------------|------------|---------|---------|------------------|
| Andrieu2 | IV | 2017 | 10 | 101 | 28.7 | 75 | 49.6 |
| Arner3 | IV | 2015 | 10 | 56 | 17.9 | 56 | 44.7 |
| Badge4 | IV | 2009 | 10 | 11 | 24.8 | 11 | 32 |
| Bakh5 | IV | 2010 | 10 | 26 | 26.3 | 25 | 66 |
| Bisson6 | IV | 2005 | 9 | 13 | 19 | 8 | 36 |
| Bradley7 | II | 2006 | 12 | 11 | 23 | 77 | 27.65 |
| Bradley8 | II | 2013 | 12 | 183 | 24.3 | 135 | 36 |
| Goubier9 | IV | 2003 | 8 | 13 | 33 | 7 | 34 |
| Kallathagen10 | III | 2016 | 10 | 38 | 27.6 | 35 | 51.6 |
| Korche11 | IV | 2019 | 9 | 32 | 20.5 | 32 | 41.58 |
| Kim12 | IV | 2003 | 9 | 27 | 21 | 25 | 39 |
| Kraeutler13 | III | 2018 | 8 | 22 | 26.6 | 21 | 43.2 |
| Lenart14 | IV | 2012 | 9 | 32 | 21.4 | 26 | 35.5 |
| Mair15 | IV | 1998 | 7 | 9 | 18.8 | 9 | 30 |
| McClincy16 | III | 2015 | 13 | 96 | 17.7 | 68 | 37 |
| McIntyre17 | IV | 1997 | 10 | 20 | 22 | 15 | 31 |
| Pennington18 | IV | 2010 | 10 | 28 | 21 | 24 | 27 |
| Radvkski19 | II | 2008 | 8 | 98 | 24 | 75 | 28 |
| Roberts20 | IV | 2017 | 8 | 62 | 30 | 13 | 35 |
| Schwartz21 | IV | 2013 | 10 | 18 | 28.7 | 26 | 61 |
| Wanich22 | IV | 2012 | 10 | 26 | 26 | 11 | 33 |

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram representing study inclusion process.
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 \(I^2\) 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 homogeneous 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

### Table II

| Study          | Patients, n | RTS, mo | RTS preinjury level, n | Time to RTS, mo | Prevaling symptom | Macrotrauma, n | Microtrauma, n | Satisfied with surgery, n | Reoperation, n | Study population    |
|----------------|-------------|---------|------------------------|-----------------|-------------------|----------------|----------------|-------------------------|----------------|---------------------|
| Andrieu\(^4\) | 101         | 81      | 81                     | 7.6             | 101               | —              | —              | —                       | 79             | —                   |
| Arner\(^4\)   | 56          | 52      | 44                     | 6               | 56                | —              | —              | —                       | 56             | —                   |
| Badge\(^4\)   | 11          | 11      | 11                     | 4.3             | 3                 | 8              | 11             | —                       | —              | —                   |
| Bahk\(^4\)    | 29          | 22      | 17                     | —               | 29                | 24             | 5              | 26                      | —              | —                   |
| Bisson\(^4\)  | 13          | 13      | 6                      | —               | 13                | 11             | 2              | 1                       | —              | —                   |
| Bradley\(^9\) | 100         | 89      | 67                     | 6               | 100               | —              | —              | —                       | 53             | 47                  |
| Bradley\(^10\)| 183         | 180     | 127                    | —               | 183               | 100            | —              | —                       | 172            | 13                  |
| Goubier\(^7\) | 13          | 8       | 8                      | 13              | 9                 | 11             | 2              | 2                       | —              | —                   |
| Kattah\(^9\)  | 38          | 22      | —                      | —               | 38                | 20             | —              | 2                       | —              | 2                   |
| Kercher\(^20\)| 32          | 30      | 20                     | 6               | 7                 | 25             | 24             | 8                       | 30             | 1                   |
| Kim\(^21\)    | 27          | 26      | 26                     | —               | 27                | 27             | —              | —                       | —              | 0                   |
| Kraeutler\(^9\)| 22      | 15      | 12                     | 7.7             | 22                | —              | —              | —                       | —              | —                   |
| Lenart\(^9\)  | 32          | 32      | 32                     | 6               | 32                | 25             | —              | —                       | —              | 0                   |
| Main\(^7\)    | 9           | 9       | 9                      | 4               | 5                 | 4              | —              | —                       | —              | —                   |
| McClincy\(^28\)| 96         | 83      | 63                     | —               | 96                | —              | —              | —                       | —              | 4                   |
| McIntyre\(^39\)| 20     | 17      | 17                     | —               | 15                | 19             | —              | 16                      | 5              | —                   |
| Penningen\(^2\)| 28      | 26      | 23                     | —               | 8                 | 20             | 28             | 26                      | —              | —                   |
| Radkowski\(^21\)| 107       | 96      | 72                     | —               | 107               | 53             | 54             | 8                       | —              | —                   |
| Robins\(^3\)  | 62          | 55      | 55                     | 62              | 62                | —              | —              | —                       | —              | —                   |
| Schwartz\(^3\)| 19          | 16      | 9                      | —               | 19                | 12             | —              | 16                      | 7              | —                   |
| Wani\(^38\)   | 12          | 11      | 11                     | 6.5             | 12                | —              | 12             | 0                       | —              | —                   |
| Williams\(^39\)| 26         | 24      | —                      | 6               | 26                | 26             | —              | 25                      | 2              | —                   |
| Wolf\(^2\)    | 14          | 9       | 9                      | —               | 14                | 6              | 4              | 10                      | 1              | —                   |

### Table III

| Study          | Preoperative scores | Postoperative scores |
|----------------|---------------------|----------------------|
|                | VAS     | ASES    | VAS     | ASES    |
| Andrieu\(^4\) | 5.4     | —       | 2.39    | —       |
| Arner\(^4\)   | 47.4 ± 21 | —       | 87.9 ± 13 | —       |
| Badge\(^4\)   | 45.9     | —       | 90.7 (53.3-100) | —       |
| Bahk\(^4\)    | 56.0 (10-92) | 50.4 (14-92) | 1.7 (0-7.5) | 85.7 (31-100) |
| Bisson\(^4\)  | 66.6 (18.3-91.6) | —       | 97.6 (38.3-99.9) | —       |
| Bradley\(^9\) | 4.34    | 65.4    | 0.33    | 96.3    |
| Bradley\(^10\)| 4.5 ± 1.8 | 51.2 ± 10.9 | 0.2 ± 0.4 | 96.5 ± 4.7 |
| Goubier\(^7\) | 3.5 ± 2.1 | 67.9 ± 15.2 | 0.8 ± 1.3 | 93.2 ± 8.9 |
| Kattah\(^9\)  | 5.9 ± 2.1 | 44.8 ± 13.5 | 0.38 ± 0.5 | 92.5 ± 11.4 |
| Kercher\(^20\)| 50.12    | —       | 85.8    | —       |
| Kim\(^21\)    | 46.6 (3-04) | —       | 85.2 (25-100) | —       |
| Kraeutler\(^9\)| —       | —       | —       | —       |
| Lenart\(^9\)  | 5.9 ± 2.1 | 44.8 ± 13.5 | 0.38 ± 0.5 | 92.5 ± 11.4 |
| Robins\(^3\)  | 50.12    | —       | 85.8    | —       |
| Schwartz\(^3\)| 50.12    | —       | 85.8    | —       |
| Wani\(^38\)   | 50.12    | —       | 85.8    | —       |
| Williams\(^39\)| —       | —       | —       | —       |
| Wolf\(^2\)    | 50.12    | —       | 85.8    | —       |

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).
posterior labral tear but did not have instability had macro-
traumatic 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 studies2,3,5,10,15,19,21,23,24,30,31,35
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 studies2,3,5,10,15,19,21,23,24,30,31,35
were Level IV evidence. Also, many of the studies had small sam-
ple 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 vari-
ability 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 gle-
nohumeral 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

The authors, their immediate families, and any research foundations with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

References

1. Abdul-Rassoul H, Galvin JW, Curry EJ, Simon J, Li X. Return to sport after surgical treatment for anterior shoulder instability: a systematic review. Am J Sports Med 2019;47:NP24–7. https://doi.org/10.1177/0363546519825642.
2. Andrews JK, Barth J, Saffarin 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.rchot.2017.08.011.
3. Arner JW, McClyn CP, 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.
4. 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/10.4103/0973-0402.50875.
5. 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.
6. Bigliani LU, Pollock RG, McIlveen SJ, Endrizzi DP, Flatow EL. Shift of the posterosuperior aspect of the capsule for recurrent posterior glenohumeral instability. J Bone Joint Surg Am 1995;77:1011–20.
7. Bisson LJ. Thermal capsulorrhaphy for isolated posterior instability of the glenohumeral joint without labral detachment. Am J Sports Med 2003;33:1898–904. https://doi.org/10.1177/0363546502572828.
8. Blomquist E, Solheim E, Liavaag S, Schroder CP, Espehaug B, Havelin LJ. Shoulder instability surgery in Norway. Acta Orthop 2012;83:165–70. https://doi.org/10.3109/19456033.2011.584063.
9. Bradley JP, Baker CL 3rd, Kline AJ, Armel DR, Chhabra A. Arthroscopic capsulolabral repair in 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.
10. McIntyre LF, Caspari RB, Savioe FH. The arthroscopic treatment of multidirectional shoulder instability: two-year results of a multiple suture technique. Arthroscopy 1997;13:418–25.
11. Pennington WT, Syrorna MA, Gibbons DJ, Bartz BA, Dodd M, Daun J, et al. Arthroscopic posterior shoulder 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.
12. Radkowsi 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.
13. 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/10.1080/00913847.2016.1166888.
14. Robins RJ, Dariuwalla JH, Gamrscdt SC, McCarty EC, Drago 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.
15. Savioe FH, Holt MS, Field LD, Ramsey JR. Arthroscopic management of posterior shoulder instability: evolution of technique and results. Arthroscopy 2008;24:389–96. https://doi.org/10.1016/j.arthro.2007.11.004.
16. Schwartz DG, Goebel S, Piper K, Kordasiewicz B, Boyle S, Lalose J. 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.
17. Tjumaakas JP, Bradley JP. Arthroscopic treatment of posterior shoulder instability. Oper Tech Sports Med Surg 2012;21:18–23.
18. Van Tongel A, Karelse A, Berghs B, Verdonk R, De Wilde L. Posterior subluxation of the shoulder: an anatomical study. Int J Shoulder Surg 1999;3:21–5.
19. 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/s11999-012-2542-4.
20. Williams RJ 3rd, Strickland S, Cohen M, Albeck DJ, Warren RF. Arthroscopic repair for traumatic posterior shoulder instability. Am J Sports Med 2003;31:203–9. https://doi.org/10.1177/036354650310200801.
21. Wolf EM, Eakin CL. Arthroscopic capsular plication for posterior shoulder instability. Arthroscopy 1998;14:151–63. https://doi.org/10.1016/s0749-8063(98)70034-9.