

Return to Play After Revision Anterior Shoulder Stabilization

A Systematic Review

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Background: Revision shoulder stabilizations are becoming increasingly common. Returning to play after revision shoulder stabilizations is important to patients.

Purpose: To evaluate the return-to-play rate after revision anterior shoulder stabilization using arthroscopic, open, coracoid transfer, or free bone block procedures.

Study Design: Systematic review; Level of evidence, 4.

Methods: All English-language studies published between 2000 and 2020 that reported on return to play after revision anterior shoulder stabilization were reviewed. Clinical outcomes that were evaluated included rate of overall return to play, level of return to play, and time to return to play. Study quality was evaluated using the Downs and Black quality assessment score.

Results: Eighteen studies (1 level 2; 17 level 4; mean Downs and Black score, 10.1/31) on revision anterior shoulder stabilization reported on return to play and met inclusion criteria (7 arthroscopic, 5 open, 3 Latarjet, and 3 bony augmentation), with a total of 564 revision cases (mean age, 27.9 years; 84.1% male). The weighted mean length of follow-up was 52.5 months. The overall weighted rate of return to play was 80.1%. The weighted mean rate of return to play was 84.0% (n = 153) after arthroscopic revision, 91.5% (n = 153) after open revision, 88.1% (n = 149) after Latarjet, and 73.8% (n = 65) after bone augmentation. The weighted mean rate of return to same level of play was 69.7% for arthroscopic revision, 70.0% for open revision, 67.1% for Latarjet revision, and 61.8% after bone block revision. There were 5 studies that reported on time to return to play, with a weighted mean of 7.75 months (4 arthroscopic) and 5.2 months (1 Latarjet). The weighted mean rates of complication (for studies that provided it) were 3.3% after arthroscopic revision (n = 174), 3.5% after open revision (n = 110), 9.3% after Latarjet revision (n = 108), and 45.8% after bone block revision (n = 72).

Conclusion: Revision using open stabilization demonstrated the highest return-to-play rate. Revision using Latarjet had the quickest time to return to play but had higher complication rates. When evaluated for return to same level of play, arthroscopic, open, and Latarjet had similar rates, and bone block had lower rates. The choice of an optimal revision shoulder stabilization technique, however, depends on patient goals. Higher-quality studies are needed to compare treatments regarding return to play after revision shoulder stabilization.

Keywords: revision shoulder stabilization; return to sport; time to return to play; arthroscopic; open; Latarjet; free bone block

Shoulder instability is a common condition, related to both activity level and age, with a reported incidence as high as 3% in the high-demand military population and 5.7% per season in adolescent rugby players.^{15,27} Anterior shoulder dislocation rates in the civilian population have been reported between 0.08 and 0.24 per 1000 person-years

compared with a near order of magnitude greater incidence in the general US military population (1.69 per 1000 person-years).^{27,37} These injuries may affect immediate and long-term athletic and functional performance. Patients who experience recurrent instability have reported poor self-reported outcomes using disease-specific quality-of-life and shoulder function metrics.^{18,31}

After an initial traumatic anterior shoulder dislocation, the incidence of recurrent instability is high, with reported rates up to 70% to 82% in athletes <20 years of age.^{14,31,36}

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As such, in athletes there is growing support for surgical management of first-time dislocations.^{7,34,39} However, the risk of recurrence after primary surgical stabilization depends on the surgical technique; however, it can be as high as 60%, and one of the most at-risk populations is young athletes.^{7,39} As surgical treatment becomes more common, particularly in young patients with many active years remaining, the requirement for and frequency of revision shoulder stabilizations is increasing.⁵

In the athletic population, the goal of resuming sports participation is a major driver for treatment decision making; however, the revision surgical technique that offers the highest return-to-sport potential remains elusive. Many factors contribute to successful return to play, including the type of sport (collision/impact vs noncollision or overhead vs non-overhead), the level of sport (recreational, high school, collegiate, or professional) and the time of recurrent instability in relation to the sport's season.^{6,26} Another critical factor to consider is whether athletes are able to return to the same level of sport or a lower level or are required to return to play in a different sport after their surgical intervention. Last, length of time to competitive return may play a major role in surgical decision making, particularly when considering in season versus out of season, contract limits, negotiations, and career length. Return to play after primary shoulder stabilizations has been reported to be 97.5% after arthroscopic repair and 86.1% after open repair,¹ but return-to-play rates in the revision shoulder stabilization setting have not been reported.

The treatment algorithm for failed shoulder stabilization is based on the degree of bone loss, the type of sport involved, and the technical aspects of the index surgery. Surgical options include soft tissue repair, whether arthroscopic or open Bankart repair, and bone augmentation procedures. Bony procedures include coracoid transfer (Bristow-Latarjet procedures) and glenoid bone augmentation using autograft or allograft.¹³ Despite the increasing number of revision shoulder stabilizations, there is a relative paucity of studies reporting return to play after these revision procedures. Most studies on revision shoulder stabilization have a limited number of participants, and as a result, most studies have focused on a single technique rather than allowing comparison of techniques.

The purpose of this study was to perform a systematic review of clinical studies on revision anterior shoulder stabilization to determine the rate of return to sport after revision techniques including arthroscopic soft tissue repair,

open soft tissue repair, coracoid transfer (Latarjet), and free bone block augmentation. We hypothesized that all revision techniques would have similar rates of return to play but that athletes who undergo bony procedures may have more difficulty returning to the same level of play.

METHODS

Study Design

To investigate the study hypothesis, a systematic review was performed on return to play after revision shoulder stabilization. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines were followed to evaluate and assess study methodology.²³ This review was prospectively registered with PROSPERO (CRD42018109043) before data extraction.

Search Strategy

A systematic, computerized search of the literature in PubMed, Embase, and Scopus databases was conducted by a medical research librarian (L.L.) using controlled vocabulary and keywords related to shoulder joint instability and revision surgery. Search words included “shoulder joint/surgery,” “shoulder dislocation/surgery,” “reoperation,” “revision,” “arthroscopy,” “bony,” “arthroscopic,” “Bankart,” “Latarjet,” “glenoid,” “autograft,” “allograft,” and their iterations. The search time frame was between May 2000 and May 2020. The search included posters, abstracts, and conference proceedings. The reference lists of all selected publications were checked to retrieve relevant publications that were not identified in the computerized search. To identify relevant articles, 2 reviewers (B.C.L., L.B.P.) independently screened the titles and abstracts of all identified citations. Full-text articles were retrieved if the abstract provided insufficient information to establish eligibility or if the article had passed the first eligibility screening.

Eligibility Criteria

Original articles were included if (1) outcomes of revision shoulder stabilization were reported with or without concomitant procedures for studies of all levels of evidence, (2) the full text was available in English, and (3) the study was

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published in a peer-reviewed journal. Case reports, systematic reviews, imaging reviews, animal studies, anatomic or histologic studies, surgical technical reports, studies with fewer than 5 participants, and studies using thermal shrinkage as an exclusive method of shoulder stabilization were excluded. Studies that presented outcomes in only primary shoulder stabilizations were excluded. Studies were included if they presented outcomes from both primary and revision cases and provided separate information on revision cases from primary cases. Studies including adhesive capsulitis, shoulder arthroplasty, and rotator cuff surgery were excluded.

Study Selection

Two authors (B.C.L. and L.B.P.) independently assessed eligible studies identified using the search strategy. Two authors (B.C.L. and M.W.) independently assessed full-text relevancy according to inclusion and exclusion criteria. If no consensus was reached, the senior author (J.C.R.) was available to make the final decision regarding eligibility. The authors performed additional citation tracking by screening the reference lists of the eligible studies.

Data Abstraction

Reviewers (B.C.L., L.B.P., T.R.J., B.P.G., M.W., and A.N.F.) collected and recorded data in duplicate in a customized database using a Microsoft Excel spreadsheet (Version 2007; Microsoft Corp). If data extraction disagreements were present, they were resolved by J.C.R. Data regarding study design, sample size, age, sex, follow-up, timing of surgery, surgical methods, concomitant procedures, and complications were recorded. Furthermore, indications for surgery were verified to be for symptomatic instability. Outcomes included whether athletes returned to play, the level at which they returned to play (same or lower), and the time to return to play. Whenever outcomes at multiple time points were reported, values from the last recorded follow-up were used.

Quality Assessment

The level of evidence (levels 1-4) of the included studies was assessed by reviewers independently using the American Academy of Orthopaedic Surgeons Classification System for Orthopaedic Literature.¹² The Downs and Black methodology was also used to assess the methodologic quality of the included studies.¹⁰ Reviewers thoroughly reviewed guidelines for grading studies before study grading. Using the Downs and Black checklist, a total maximum score of 31 was possible. Discrepancies in scoring were discussed among the reviewers.

Statistical Analysis

Given the nonuniform nature of the studies included in this systematic review in terms of techniques and outcome reporting, the results were presented in a narrative summary fashion. For descriptive purposes, weighted averages

for age, length of follow-up, return to sport, return to same level of sport, return to lower level of sport, time to return to sport, and complications were calculated.

RESULTS

A total of 3467 studies were identified in an initial exploration of database and reference searches. After duplicates were removed, a total of 3063 titles and abstracts were screened. After review of titles and abstracts, eligibility for inclusion was determined in 66 studies. During full-text review, 48 studies were excluded because they were found to be unrelated to revision anterior shoulder stabilization or did not provide return-to-play metrics. There were 18 remaining studies included in the final quality assessment and analysis (Figure 1). Selected article characteristics can be found in Table 1.

The quality of the 18 nonrandomized studies was assessed using the Downs and Black criteria.¹⁰ The median Downs and Black score for the included studies was 10.1 out of 31. There were no randomized controlled studies (evidence level 1).

Descriptive Statistics

The weighted mean length of clinical follow-up after revision surgery 52.5 months (SD, 22.6 months). The average study sample size was 31.3 revision cases, with a range of 11 to 65 cases, and 564 total cases reported. The majority of patients were male (84.1%) and young, with an average age of 27.9 ± 3.6 years at the time of surgery. The overall weighted rate of return to play was 80.1%. Of the 18 studies included, 8 differentiated return to same-level versus lower-level sport (2 arthroscopic, 4 open, 1 Latarjet, 1 bone block). In those 8 studies, the overall return-to-play rate was 95.5%, with 76.5% returning to the same level and 19.0% returning to a lower level.

Return to Play After Revision Arthroscopic Bankart Repair

Seven studies dating between 2002 and 2014 reported return to play after arthroscopic revision Bankart repair in a total of 153 athletes.^{2-4,9,17,24,28} The average follow-up was 39.1 months (SD, 8.29). Table 1 shows the weighted mean complication rate of 3.3% (range, 0%-6.25%), and Table 2 demonstrates the weighted mean and return-to-play mean rate of 84.0% (range, 56.25%-100%). There were 2 studies that differentiated level of return to play after arthroscopic revisions (n = 66 operations). In these studies, the overall weighted mean return-to-play rate was 96.8%, with a weighted mean of 69.7% returning to the same level and 27.3% returning to a lower level.^{18,19} Four studies reported time to return to play with a weighted average of 7.75 months (range, 5.7-9 months)^{3,17,24,28} (Table 2).

A wide range of sports were included in the reviewed studies. Arce et al² reported outcomes in athletes who participated in tennis, soccer, volleyball, golf, and skiing and excluded contact athletes. However, in reporting return-to-

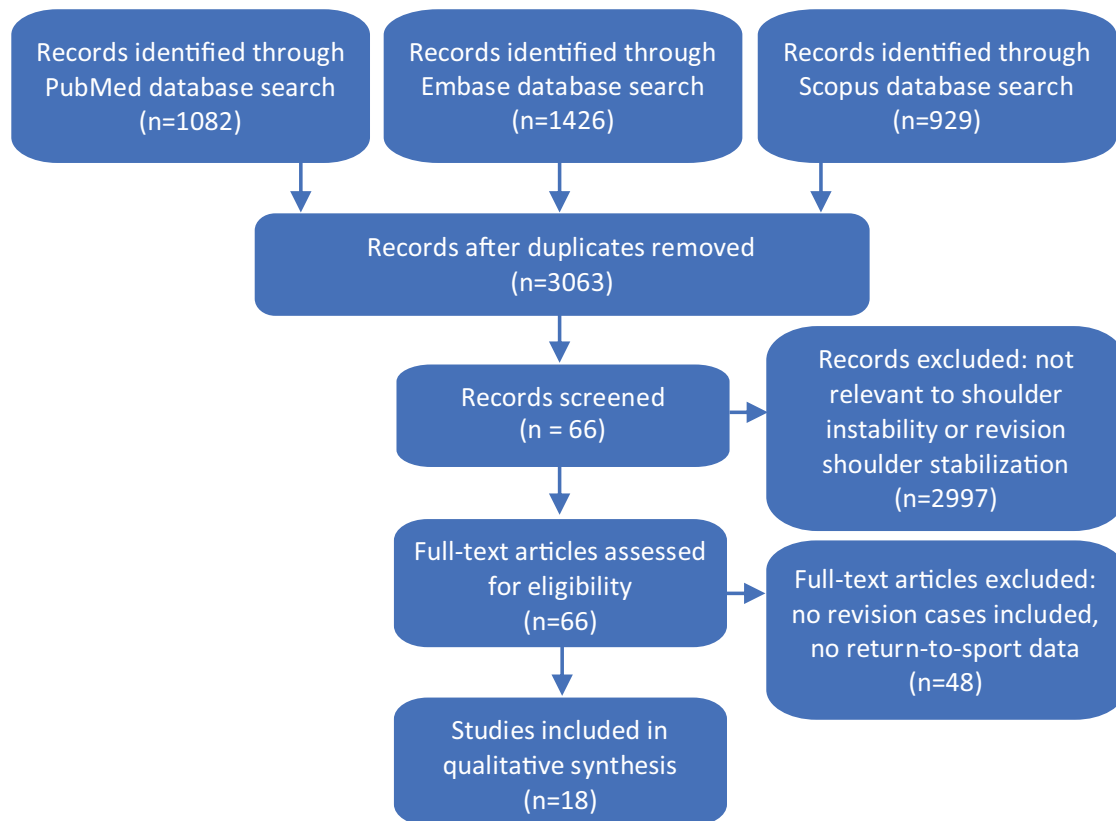


Figure 1. Flowchart showing search strategy for studies to be included in the review.

play data, the sport played was not reported. Patel et al²⁸ did report level of activity, including 65% recreational, 25% collegiate, 5% high school, and 5% professional but did not specify which sport or whether level of activity influenced return to sport or level of return. Kim et al¹⁷ also reported level of activity, with 30% contact sports and 26% overhead sports as well as 39% collegiate athletes. The 5 athletes with residual instability in this study played collegiate rugby, collegiate judo, collegiate basketball, and recreational soccer, and the remaining patient was a manual laborer. Neri et al²⁴ included athletes from volleyball, baseball, basketball, hockey, football, and rock climbing, and the majority were recreational (42%) or high school (25%) level, and a smaller percentage were collegiate or professional level (17% and 8%, respectively). Of the 3 recurrences in the study, 2 were in contact athletes: hockey player and snowboarder. Bartl et al³ included contact sports with 3 professional, 10 semiprofessional, and 39 recreational athletes and further classified them into overhead sports (40%), contact sports (30%), and other sports (30%), but they did not specify which sports. The study, however, utilized a sports activity assessment tool to indicate which percentage of normal (100%) they felt throughout their care. The mean score preinjury was 46.6%, and after injury it was 82%.

Interestingly, only 1 (handball) of the 3 professional athletes versus 75% of the semiprofessional athletes returned to their previous activity level. The study also found no

difference in return to sport in patients who had an initial arthroscopic or open repair before their revision arthroscopic repair.³

Bone loss was reported inconsistently throughout the studies. Arce et al² and Neri et al²⁴ excluded bone loss, while Bartl et al³ did not discuss bone loss. Kim et al¹⁷ reported that 61% of patients had glenoid bone loss and, more specifically, that <10% bone loss was present in 30% of patients, 11% to 20% bone loss in 17% of patients, and 21% to 30% bone loss in 13% of patients.¹⁴ However, the degree of bone loss did not affect the return to sport significantly.

Boileau et al⁴ specifically evaluated revision arthroscopic stabilization after failed open anterior shoulder stabilization (Latarjet, Eden-Hybinette, open Bankart, open capsular shift); there were 5 patients who had 2 previous open procedures and 1 patient who had 3 previous procedures (thermal capsulorrhaphy, Latarjet, and Eden-Hybinette). Only 47% returned to sports, but all returned to their previous occupation, including 6 who suffered occupational injury. The study did not specify which of the athletes/activities were successful in return to play postoperatively.

Return to Play After Revision Open Bankart Repair

There were 5 studies dating between 2000 and 2015 on open revision repair, with a total of 159 athletes.^{8,19,22,25,35} The average follow-up was 66.96 months (range, 42-122.4 months). The weighted mean rate of return to play was

TABLE 1
Article Descriptions and Average Age, Complication Rate, and Mean Follow-up of Patients^a

Lead Author (Year)	LOE	No. of Patients	Mean Age, y	Complication Rate, %	Mean Follow-up, mo
Arthroscopic revision					
Arce (2012) ²	4	16	26.8	NA	30.9
Bartl (2011) ³	4	56	29.4	6 (shoulder stiffness, loose anchor)	37
Boileau (2009) ⁴	4	22		6.25 (reflex sympathetic dystrophy)	43
De Giorgi (2014) ⁹	4	22/22	27	0	56
Kim (2002) ¹⁷	2	23	24	4.3 (transient neurapraxia)	36
Neri (2007) ²⁴	4	11	28	0	34.5
Patel (2008) ²⁸	4	40	33.1	0	36
Open Bankart revision					
Cho (2009) ⁸	4	25 ^b	24	NA	42
Levine (2000) ¹⁹	4	50	27	0	56.4
Neviaser (2015) ²⁵	4	30	31	13.0 (progressive arthritis)	122.4
Sisto (2007) ³⁵	4	30	24	0	46
Marquardt (2007) ²²	4	24 ^c	24.3	NA	68
Latarjet revision					
Ranalletta (2018) ³⁰	4	65	26.8	12.3 (reoperation, graft fragmentation, nonunion, intra-articular screw, septic arthritis, superficial wound infection)	44
Kee (2018) ¹⁶	4	56 (42 revision)	26.5	NA	67
Privitera (2018) ²⁹	4	109 (42 revision) ^d	25.8	4.7 (painful screws removed at 1.5 y postoperatively; impingement, subsequent subacromial and subcoracoid decompression)	51.6
Bone block revision					
Giannakos (2017) ¹¹	4	12	37.5	58.3 (reoperation for hardware impinging on humeral head, arthroscopic brachial plexus release, screw breakage, nonunion)	28.8
Lunn (2008) ²⁰	4	34	30	50	81.6
Willemot (2019) ³⁸	4	26	29.4	34.60	43.7

^aLOE, level of evidence; NA, not available.

^bCho et al⁸ had 25 patients but 26 shoulders (1 shoulder was bilateral).

^cMarquardt et al²² had 24 patients but 16 revision cases. The remaining 8 cases were primary.

^dOf the patients undergoing revision, there were 24 with 1 previous surgery and 18 with ≥ 2 previous surgeries.

91.5% after open revision. Four of these studies differentiated the level of return to play after open revisions ($n = 102$ surgical cases) with an overall weighted mean return-to-play of 90.3%^{8,22,25,35} (Table 2).

None of these studies reported on time to return to play after revision open Bankart repair. The weighted mean complication rate was 3.5% ($n = 110$). In the included studies, the management of the subscapularis tendon did not appear to play a role in return to play. Irrespective of the used technique (subscapularis split,⁸ peel,¹⁹ or tenotomy^{22,25,35}), there were similar return-to-play levels. Sisto³⁵ performed a subscapularis tenotomy in high school, collegiate, and recreation athletes. At the final follow-up, 2 high school swimmers and 2 high school baseball players did not return to play. Marquardt et al²² performed a subscapularis tenotomy on 5 highly competitive and 19 recreational-level athletes but did not report outcomes with respect to athletic level. Levine et al¹⁹ did not report findings based on level of sport and did not include professional athletes. Of note, all techniques for labral management were anchor-based repairs.

There was a mix of activity and athletic level, which similarly did not appear to affect return to play. Cho et al⁸ determined that 23% of the included patients were high risk because of the nature of the sport (11.5% collision and 11.5% contact/overhead sports). Neviaser et al²⁵ reported on 12 competitive athletes and 10 recreational athletes but reported a high return-to-play rate (95.70%). However, the level of return was not delineated for these patients.

Return to Play After Open Latarjet

There were 3 studies on revision Latarjet procedures (all level 4 evidence) that met the inclusion criteria, with a total of 150 athletes with revision procedures.^{16,29,30} The weighted mean athlete age was 26.4 years (range, 17-58 years), and the weighted mean follow-up was 55.6 months (range, 44-51.6 months). The weighted mean complication rate was 9.3% ($n = 108$) and included graft fragmentation, graft nonunion, intra-articular screws, septic arthritis, impingement, and superficial wound infection. The rate of return to play was 88.1% after revision Latarjet. The rate of

TABLE 2
Rate of Return to Play^a

Lead Author (Year)	Level of Athletics, n (%)	Sports Involved, n (%)	Rate of Return to Play, %	Return to Same Level, %	Return to Lower Level, %	Time to Return to Play, mo
Arthroscopic revision						
Arce (2012) ²	NA	Collision, 7 (43); overhead, 6 (37); NC/NOV, 1 (6)	87.5	50	37.5	NA
Bartl (2011) ³	Professional, ^b 3 (23); recreational, 39 (70); none, 4 (7)	Collision, 17 (30); overhead, 22 (40); other sports, 17 (30)	100	76	24	9.0
Boileau (2009) ⁴	NA	Collision, 3 (13); overhead, 11 (50); NC/NOV, 2 (9)	47	NA	NA	NA
De Giorgi (2014) ⁹	NA	Overhead, 5 (23)	100	NA	NA	NA
Kim (2002) ¹⁷	Collegiate, 9 (39); recreational, 4 (17); none, 10 (44)	Collision, 7 (30); overhead, 11 (50)	78.26	NA	NA	5.7
Neri (2007) ²⁴	Professional, 1 (8); collegiate, 2 (17); high school, 3 (25); recreational, 5 (42)	NA ^c	63.6	NA	NA	8.5
Patel (2008) ²⁸	Professional, 2 (5); collegiate, 10 (25); high school, 3 (5); recreational, 26 (65)	NA	80	NA	NA	7.8
Open Bankart revision						
Cho (2009) ⁸	NA	Collision, 3 (11.5); overhead, 3 (11.5); none, 20 (77)	84.62	84.62	15.38	NA
Levine (2000) ¹⁹	Professional, 0 (0)	NA	94	NA	NA	NA
Neviaser (2015) ²⁵	Competitive, 12 (40); recreational, 10 (33)	NA	95.7	73.91	21.74	NA
Sisto (2007) ³⁵	NA	Collision, 22 (73); overhead, 8 (27)	100	87	13.33	NA
Marquardt (2007) ²²	Competitive, 5 (21); recreational, 19 (79)	Collision, 2 (8); overhead, 3 (12)	79.17	45.83	33.33	NA
Latarjet revision						
Ranalletta (2018) ³⁰	Competitive, 55 (85); recreational, 10 (15)	Collision, 43 (66); overhead, 9 (14); NC/ NOV, 9 (14); martial arts, 4 (6)	100	95.38	4.62	5.2
Kee (2018) ¹⁶	Competitive, 16 (29); recreational, 40 (71)	Collision, 54 (74); overhead, 8 (11); NC/ NOV, 1 (1); martial arts, 10 (14)	100	23.2	66.1	NA
Privitera (2018) ²⁹	Professional/collegiate, 23 (32); high school, 19 (26); recreational, 29 (40)		75, 39 ^d	NA	NA	NA
Bone block revision						
Giannakos (2017) ¹¹	NA	NA	58.33	NA	NA	NA
Lunn (2008) ²⁰	NA	NA	94.1	61.76	32.35	NA
Willemot (2019) ³⁸	Competitive, (30.5); recreational, (38.4)	NA	47.4	NA	NA	NA

^aCollision sports: football, soccer, skiing, basketball, ultimate frisbee, diving, and surfing; overhead sports: volleyball, tennis, baseball, softball, swimming, and handball; martial arts sports: boxing, wrestling, judo, and taekwondo; noncollision/nonoverhead sports (NC/NOV): golf. NA, not available.

^bIncludes professional and semiprofessional athletes.

^cGeneral inclusion of sports was included but specific numbers within collision or overhead athletics was not provided.

^dRates included 75% for 1 previous stabilization and 39% for ≥ 2 stabilizations.

return to the same level of play was 67.1%, with a 28.7% rate of return to a lower level. The average time to return to play was 5.2 months (range, 4-11 months). It was not specified whether time to return differed between levels of return.

Ranalletta and colleagues³⁰ classified sport participation into 4 categories: (1) noncollision/nonoverhead shoulder sport; (2) high-impact/collision sport; (3) overhead sport; and (4) martial arts sport. They also defined competitive sport as regular practice or competition >2 times per week and recreational sport as regular practice or competition <2 times per week. All but 3 athletes were able to return to the same level of play. Two of the 3 who switched sports were rugby players who changed to CrossFit and soccer. The third was previously in acrobatics and switched to running. Interestingly, functional outcomes were not related to the level of competition before sport. They specifically looked at type of sport and length of time to return to sport. Noncollision/nonoverhead athletes (9 patients) returned significantly faster (3.3 months) compared with high-impact/collision sport athletes (43 patients; 5.3 months), overhead sport athletes (9 patients; 5.7 months), and martial arts sport athletes (4 patients; 5.8 months). When comparing competitive versus recreational athletes, the study did not find a significant difference in time to return to play (5.1 vs 5.4 months, respectively). This group reported that the rate of return to play was high even in the riskiest sports and despite the fact that all athletes had at least 1 previous surgery. Specifically, 95% of contact and collision athletes returned to play, and all returned at the same preinjury level.

Kee et al¹⁶ studied 42 patients with previous instability surgery and 14 who underwent a primary Latarjet procedure. In regard to return to play, there was no significant difference between the revision and primary groups. These included sports, such as soccer, rugby, boxing, wrestling, martial arts, basketball, skiing, baseball, swimming, badminton, volleyball, taekwondo, and tennis. There was also no significant difference between the competitive (n = 16) and recreational (n = 40) groups. The study reported on level of return to play but did not separate revision versus primary surgeries when reporting on the level of return.

Privitera and colleagues²⁹ stratified revision cases by the number of previous surgeries (1 previous vs ≥ 2 previous) and found that the greater the number of revisions, the lower the rate of return. The study also found that the percentage of bone loss (regardless of number of prior surgeries) did not affect return to play. Patients with a single revision had a 75% rate of return to play, while patients with ≥ 2 revisions returned at a rate of 39%. Two or more previous surgeries resulted in a relative risk of 2.84 times less likelihood to return to play than did a single previous surgery. Rate of return to sport based on level of competition was 66% for recreational; 63% for high school; and 65% for professional, and collegiate athletes.

Return to Play After Revision Bone Block Augmentation

There were 3 studies dating between 2008 and 2019 on bone block revision with a total of 65 athletes^{11,20,38} (Table 1).

The weighted average follow-up was 51.4 months, and the weighted average complication rate was 45.8% (range, 34.6%-58.3%). The weighted mean rate of return to play was 73.8% after bone augmentation. One of these studies differentiated level of return to play for 34 athletes.²⁰ The overall return-to-play rate was 94.1%, with 61.8% returning to the same level and 32.4% returning to a lower level. However, there were no studies that reported time to return to play. All studies utilized autologous iliac crest bone block with a subscapularis split; however, Giannakos et al¹¹ reported on an all-arthroscopic technique, while Lunn et al²⁰ and Willemot et al³⁸ reported on open techniques. The details of the return to play were variably reported. In the all-arthroscopic group of Giannakos et al and the open groups of Lunn et al and Willemot et al, the authors did not report the specific sports to which athletes were able to return. Lunn et al similarly did not provide specific sporting activities but reported that 2 patients gave up sports entirely and 11 decreased their level of sporting activity. However, the mean sport/activity score was 21 ± 6.3 out of 25 for the corresponding sport/activity category of the Walch-Duplay score.

None of the studies using bone block reported any new neurovascular deficits as complications. Reported complications for the arthroscopic technique included arthroscopic removal of hardware, arthroscopic brachial plexus release, screw breakage, and fibrous nonunion.¹¹ For the open techniques, Lunn et al²⁰ noted that 3 patients reported discomfort related to the iliac crest donor site, 2 others endorsed areas of lateral hyperesthesia below the donor site scar, and 1 had superficial wound infection. Significantly, Willemot et al³⁸ reported that 53.8% of shoulders postoperatively demonstrated evidence of degenerative arthritis on radiographs, with 34.6% showing progressive evolution of their arthritis at the final follow-up.

DISCUSSION

In the current study, data from 564 athletes across 18 studies were analyzed in order to better understand the rates of return to play after revision anterior shoulder stabilization. Although overall rates of return to some level of play after surgical treatment were good across all techniques, open and Latarjet revisions had the highest rates. Return to the same level of play was also similar among arthroscopic, open, and Latarjet revisions. Latarjet revisions had the shortest amount of time to return to play, with a mean of 5.2 months. Latarjet had a complication rate of 9.3% versus 3.3% and 3.5% after arthroscopic and open revisions, respectively. Bone block techniques had the lowest rates of return to play and same level of play and the highest rates of complications.

The findings in this study demonstrate that revision shoulder stabilizations can yield similar return-to-play outcomes compared with primary stabilization techniques if appropriate patient selection is performed. A recent systematic review of primary shoulder stabilizations reported a return to any level of 97.5% with arthroscopic repair and a return of 86.1% with open repair.¹ Contrarily, the current

study showed a better return-to-play rate with open than arthroscopic repair (91.5% and 84%, respectively). Likewise, Abdul-Rassoul¹ reported a return-to-play rate of 73.8% with arthroscopic Latarjet. For return to the same level of play, the rates were higher for primary arthroscopic and open soft tissue repairs at 91.5% and 85.7%, respectively, compared with 69.7% and 70.0% in revision stabilization.¹ Similarly in our study, the rate of return to the same level of play after open Latarjet in the revision setting was 67% compared with 90% in the primary setting.¹

The findings from this study support the importance of evaluating and reporting not just return to play but also return to the same level of a specific sporting activity. Athletes may return to play, but if it is to a different sport or at a significantly lower level, then this may leave an athlete dissatisfied with his or her outcome. In order to best counsel an athlete before revision stabilization, we must first better understand return-to-play rates, sporting activity requirements, level at return, and time to return to play. Without routine reporting on the level of or time to return, we are providing athletes with incomplete information for these important treatment decisions. In studies that differentiated overall return to play from the same level, there was a significant discrepancy. In arthroscopic revisions there was a 27.1% difference, open revisions had a 21.3% difference, Latarjet had a 21.0% difference, and bone block revisions had a 32.3% difference. However, it is worth noting that it is not possible to determine whether these differences were due to differences in sport participation of the cohorts from each of the different studies, as this was not reported consistently or with adequate detail.

As may be expected, the type and level of sport/activity to which an athlete hopes to return also have an effect on return to play. Collision and overhead athletes had lower rates of return to same-level activity and longer recovery.^{3,24,30,35} Moreover, professional athletes had a much more difficult time returning to the same level of activity compared with semiprofessional and recreational athletes.³

Interestingly, for open or Latarjet techniques the management of the subscapularis did not appear to have an influence on return-to-play rates. Tenotomy, peel, or split was associated with similar rates of return to play. Rates of complications for open procedures, however, did exceed those for arthroscopic procedures and included serious complications, such as hardware failure/removal, nonunion/malunion, graft fragmentation, brachial plexus compression, and infection. The Latarjet procedure is a technically challenging surgery as a primary surgery and is even more difficult in the revision setting. In this study, Latarjet revision had a complication rate of 9.3% compared with 3.3% and 3.5% after arthroscopic and open revisions, respectively. Previous literature has found that even for primary shoulder stabilization using the bony procedure, there was a high rate of complications ranging from 12.3% to 25%^{30,32,33} for Latarjet repair.

In further comparison of revision Latarjet versus revision arthroscopic repair, Makhni et al²¹ compared the cost-effectiveness of revision arthroscopic repair to revision Latarjet procedure after a failed arthroscopic repair using an expected value decision analysis model. Input for this

model including procedure cost and clinical outcomes was obtained from a review of the literature. The authors reported that the revision Latarjet procedure was more cost-effective (\$13,672 vs \$15,287) than was revision arthroscopic repair or nonoperative management primarily because of the decreased cost of the procedure and improved functional outcomes (Western Ontario Shoulder Instability Index scores used).

Surgical failure can occur for numerous reasons, but one of the most important factors in shoulder stabilization is bone loss.²¹ However, in the current review of literature the majority of studies either excluded patients with bone loss or did not explicitly quantify bone loss. Only 1 study reported in detail the degree of bone loss in athletes and did not identify a relationship between bone loss and return to play.³ Future studies should include bone loss as a possible risk factor for delayed or lower level of return to play in revision shoulder stabilizations.

This systematic review has several limitations. The body of evidence included exclusively observational studies. The data reviewed came from studies of low methodologic quality (evidence levels 2 and 4) and associated poor Downs and Black scores. Furthermore, there was significant heterogeneity in techniques (eg, operative positioning, number of anchors), and few studies reported specific rehabilitation protocols. Inconsistencies also appeared with respect to how return to play was defined and reported. Moreover, timing of injury in relation to the sport season (in season, out of season, end or beginning of season) may also affect time to return to play, and this was not noted in the studies. Finally, the paucity of comparative studies precluded definitive conclusions on the efficacy of revision shoulder stabilization and how best to counsel patients.

CONCLUSION

For patients who have continued shoulder instability after an index surgery, our systematic review has shown that revision using open stabilization had the highest return to play rate. Revision using the Latarjet procedure had the quickest time to return to play but had higher complication rates. However, when evaluated as return to same level of play, arthroscopic, open, and Latarjet procedures had similar rates, and bone block had lower rates. The choice of an optimal revision shoulder stabilization technique, however, depends on complete evaluation of patient goals for sporting activity. The quality of research in return to play after revision shoulder stabilization remains poor, and higher-quality studies are needed to better evaluate and compare treatments of this difficult problem.

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