Return to Sport After Surgical Treatment for Anterior Shoulder Instability

A Systematic Review

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Background: For athletes, a return to preinjury activity levels with minimal time away is a metric indicative of successful recovery. The knowledge of this metric would be helpful for the sports medicine specialist to advise patients on appropriate expectations after surgery.

Purpose: To evaluate the rate and amount of time needed for athletes to return to sport (RTS) after different surgical treatments for anterior shoulder instability.

Study Design: Systematic review and meta-analysis.

Methods: The MEDLINE, EMBASE, and Cochrane databases were searched for articles relevant to athletes' RTS after surgical anterior shoulder stabilization with variants of the Latarjet and Bankart procedures. Article selection was based on relevant inclusion and exclusion criteria. After the articles were reviewed, the data pertinent to rates of and time to RTS were extracted, compiled, and analyzed.

Results: Sixteen articles met the inclusion criteria. Based on these articles, the rate of RTS was 97.5% after arthroscopic Bankart, 86.1% after open Bankart, 83.6% after open Latarjet, 94.0% after arthroscopic Latarjet, and 95.5% after arthroscopic Bankart with remplissage. Among the athletes who did RTS, arthroscopic Bankart had the highest rate of return to preinjury levels (91.5%), while arthroscopic Latarjet had the lowest rate (69.0%). The time to RTS was 5.9 months after arthroscopic Bankart, 8.2 months after open Bankart, 5.07 months after open Latarjet, 5.86 months after arthroscopic Latarjet, and 7 months after arthroscopic Bankart with remplissage.

Conclusion: Of the pooled data, patients who underwent arthroscopic Bankart showed the highest rate of RTS, while patients who underwent open Latarjet showed the shortest time to RTS. Return to preinjury level was highest in the arthroscopic Bankart group and lowest in the arthroscopic Latarjet group. Physicians can utilize these data to set expectations for their patient-athletes regarding RTS after anterior shoulder stabilization procedures.

Clinical Relevance: When treating an athlete, many factors must be taken into account to weigh treatment options. Two important factors to consider with the patient-athlete are the rate of return to the previous activity level and the timeline for this to occur. This study provides a guide for physicians and a time frame for athletes with respect to the mean percentage and time for return to sport after different surgical procedures for anterior shoulder instability.

Keywords: return to sport; anterior shoulder instability; Bankart; Latarjet; remplissage

Anterior glenohumeral instability, particularly recurrent instability, is a common sports injury that can cause pain, physical limitation, lower quality of life, and result in time away from sports.[25] Traumatic shoulder instability within the general population has an incidence of 1.7%, with the majority of cases resulting from sports participation.[6] Within the collegiate athlete population, glenohumeral instability has an incidence as high as 0.12 per 1000 athlete exposures. This rate is even greater in collision and contact sports such as football and wrestling.[28]

Anterior shoulder instability has a range of presentations—from pain with apprehension to subluxation and traumatic dislocation. Likewise, there is an array of treatment options, ranging from conservative immobilization and physical therapy to more invasive operative interventions, including arthroscopic and open stabilization procedures. When treated with nonoperative management, athletes commonly experience higher rates of recurrent instability as compared with surgical interventions.[1,7,8,18,33,35] As a result, competitive

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athletes often undergo surgical shoulder stabilization to return to sport (RTS) and perform at their preinjury activity levels. Determining the correct surgical treatment for a patient includes factors such as age, patient activity level, type of sport (throwing or collision), expectations, and amount of glenoid and/or humeral bone loss.[5] In the competitive athletic population, additional variables to consider include time needed for RTS, whether the athlete is in season, and the ability to participate at preinjury levels.

The success of shoulder instability treatment is defined by a lack of recurrent instability. For athletes, a return to their preinjury activity levels with minimal time away from their sports is also an important metric indicative of successful recovery. Whether the treatment includes open or arthroscopic labral repair, capsular shifts, or bone block, it is important for orthopaedic surgeons and athletes to discuss the probability of postoperative RTS and the time needed to do so, to impart accurate expectations. However, one of the challenges in determining the time to RTS for athletes after anterior shoulder stabilization surgery is defining the term *return to sport*. There is heterogeneity among studies in the literature on the definition of RTS; however, given the context, many imply that RTS is the ability to participate in competition, particularly at the preinjury level.

The goal of this systematic review is to evaluate the rate of RTS as well as the amount of time needed to RTS among athletes after different surgical treatments for anterior shoulder instability. The primary procedures reviewed include arthroscopic and open Bankart as well as Latarjet procedures.

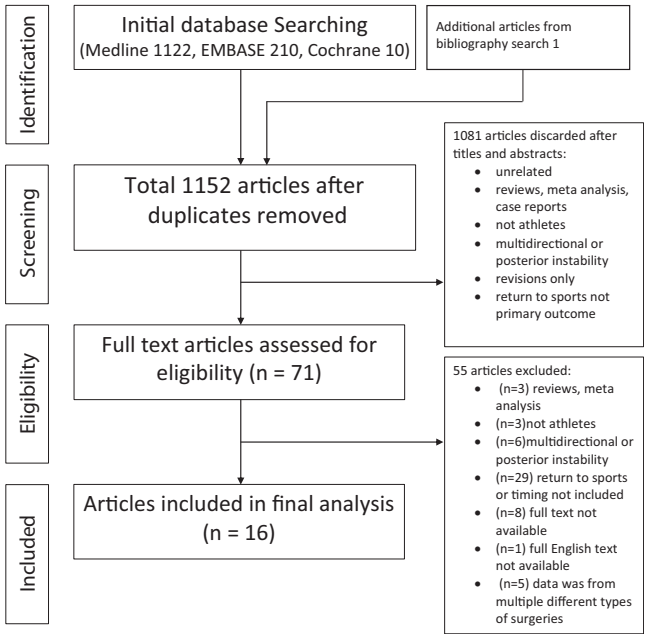

Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flowchart exhibiting search strategy to identify articles for inclusion.

METHODS

Search Strategy

A systematic and rigorous search strategy was developed according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocols (Figure 1).[26,34] This strategy yielded appropriate peer-reviewed data and articles for a systematic review over 4 phases. In phase 1, "identification," electronic databases were searched to find potentially relevant RTS and anterior shoulder instability surgery articles. Medline (PubMed), Embase (Elsevier), and the Cochrane Library were accessed and searched on August 11, 2017, with the following Boolean search terms: (((Bankart) or (Labral Repair) or (SLAP repair) or (Latarjet procedure) or (capsular shift) or (open capsular shift) or (Open Bankart) or (rotator interval closure) or (remplissage) or (capsulorrhaphy) AND ((return to sports) or (return to preinjury activity) or (athlete) or (athletics) or (athletic population) or (athlete population) or (return to competition) or (return to athletics))). To increase sensitivity, no filter was used during the database searches.

Eligibility Criteria

All search returns were extracted and examined for relevance, and duplicate search returns were discarded. In phase 2, "screening," titles and abstracts were screened for relevance. Bibliographies of relevant articles were also manually searched for other relevant articles screened out of the database algorithms. Articles were filtered out per the following exclusion criteria: (1) non-English text, (2) only abstract available, (3) population not athlete specific, (4) RTS outcomes not quantified, (5) data on posterior or multidirectional instability only, (6) either nonsurgical treatment or not one of the surgical procedures being reviewed, (7) surgical treatment with superior labral anterior and posterior (SLAP) repair without concomitant Bankart repair, (8) studies with multiple treatments without stratification by operation type, (9) review article or meta-analysis, or (10) case reports. The shoulder instability treatments being reviewed included open or arthroscopic Bankart repairs or Latarjet procedures, with possible remplissage, rotator interval closure, and thermal

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TABLE 1
Data for Included Open Bankart Repair Studies[a]

First Author; Journal[b]	Year	Surgery Type	Athletes, n	Level of Athletics	Mean Age at Surgery (Range), y	Male: Female, n	Follow-up	Subsequent Procedures[c]
Pavlik[29]; *Knee Surg Sports Traumatol Arthrosc*	1996	Open Bankart	35[d]	All professional	23.3 (17-45)	35:9	14.2 mo	None
Jobe[21]; *Am J Sports Med*	1991	Open capsulolabral reconstruction	25[e]	13 professional, 11 college, 1 high school	21 (15-27)	NA	39 mo	None
Fabre[14]; *J Shoulder Elbow Surg*	2010	Open Bankart	46[f]	39 competitive, 7 recreational	25 (17-51)	46:3	28 y	1 Bankart procedure, 1 Bristow-Latarjet procedure after reinjury
Kjeldsen[22]; *Scand J Med Sci Sports*	1996	Open Bankart	16[g]	5 elite, 8 competitive, 3 recreational	28.4 (17-47)	13:3	23.9 mo	1 modified Bankart + Putti-Platt

[a]NA, not available
[b]For each study: level of evidence, 4.
[c]There were no concomitant procedures in any study.
[d]No. of participants by sport: 44 total, 9 no follow-up; 7 handball, 7 basketball, 6 football, 4 wrestlers, 3 bicyclists, 2 weightlifters, 2 boxers, 2 motorists, 2 swimmers, 2 sailors, 2 kayakers, 2 skiers, 2 water polo, and 1 baseball.
[e]No. of participants by sport: 20 baseball (8 pitchers, 11 professionals), 2 professional football, 1 basketball, 1 softball, 1 water polo.
[f]No. of participants by sport: 49 total; 31 rugby (32 shoulders), 3 soccer, 1 skier; 6 overhead (swimming, surfing, tennis); 6 forced overhead (basketball and handball).
[g]No. of participants by sport: 2 horse riding, 1 swimming, 1 weightlifting, 7 handball, 1 skiing, 3 soccer, 1 motocross.

capsular shrinkage procedures being performed concurrently. Studies were evaluated only if (1) they included both the RTS rates and the time to RTS, centering on a specific surgical procedure, or (2) they stratified mixed patient outcomes by a single surgical procedure.

Article Review

In phase 3, "eligibility," all articles eligible after the screening phase were evaluated for inclusion criteria and relevant data on RTS timelines and outcomes after 1 of the surgical treatments of interest. All articles were reviewed, assessed, and data mined by 2 independent evaluators. All results were then compared to ensure consistency and accuracy. Any conflicts or issues were resolved by review, and in the event of further disagreement, the final decision was made by the senior authors (X.L. and J.S.).

Data Extraction and Assessment

In phase 4, "included," articles that met inclusion criteria were analyzed for quality, and data were extracted to be used in a meta-analysis. The following items of data were extracted from the included articles: author, publication year, journal title, level of evidence, study design, surgical procedure, number of athletes, types of sport, number of participants in sport type, level of athletic participation, mean age at the time of surgery, sex, mean follow-up period, concomitant procedures, percentage of athletes who returned to sports, percentage of athletes who returned to preinjury level of athletics, mean time needed to RTS after surgery, number and type of recurrent shoulder injuries, and subsequent procedures needed because of recurrent shoulder instability. A few studies included multiple surgical treatments, in which treatment types were stratified and analyzed independent of other surgical procedures. In addition, several articles were based on a mixed population (ie, nonathletes and athletes) or a mixture of shoulder instability subtypes (ie, anterior, posterior, and multidirectional). In these cases, if the relevant RTS data were stratified, then only data from the athlete population and/or anterior instability were extracted.

Quality Assessment

To assess the quality of each case series that was included in the analysis, the risk of bias in nonrandomized studies of interventions was determined.[13] This assessment included 7 criteria: (1) bias attributed to confounding, (2) bias in selection of participants into the study, (3) bias in classification of interventions, (4) bias attributed to deviations from intended interventions, (5) bias attributed to missing data, (6) bias in measurement of outcomes, and (7) bias in selection of the reported result. Each criterion was rated as low, high, or unclear risk of bias.

RESULTS

After careful review of the available literature, 14 level 4 studies and 2 level 3 studies were included in the final analysis. The studies reviewed included assessment of open Bankart repair[14,21,22,29] (Table 1), arthroscopic Bankart repair[16,20,23,24,31,32] (Table 2), variations of the Latarjet procedure[2,4,9,10,27] (Table 3), and arthroscopic Bankart repair with remplissage.[15] A total of 609 patients were available for follow-up. This included 122 open Bankart procedures, 238 arthroscopic stabilization procedures, 89 minimally invasive (arthroscopic) Latarjet procedures, 116 open Latarjet procedures, and 44 arthroscopic Bankart with Remplissage procedures. The age range at the time of surgery was 14 to 51 years. Given the limitation of the studies reviewed, the mean ± SD age across studies could not be accurately calculated. The majority of athletes participated in collision, contact, or overhead sports at the professional or competitive level. Concomitant procedures reported in 3 studies

TABLE 2
Data for Included Arthroscopic Bankart Studies[a]

First Author; Journal	Year	Level of Evidence	Surgery Type	Athletes, n	Level of Athletics, n (%)	Mean ± SD Age at Surgery (Range), y	Male: Female, n	Mean ± SD Follow-up (Range)	Concomitant Procedures; Subsequent Procedures
Ide[20]; *Am J Sports Med*	2004	4[b]	Arthroscopic Bankart	55[c]	40 competitive, 15 recreational	20.7 (15-39)	41:14	42 mo (25-72)	5 rotator interval closure; 2 revision arthroscopic Bankart repair and rotator interval closure
Stein[31]; *Am J Sports Med*	2011	4	Arthroscopic Bankart	47[d]	26 (55.3) competitive, 16 (34.0) recreational, 5 (10.7) healthy sports	26.9 ± 9	39:7 (1 female excluded, tennis)	32 mo	None; 5 arthroscopic repairs and 1 bone block transfer
Mazzocca[24]; *Am J Sports Med*	2005	4	Arthroscopic Bankart	18[e]	14 high school, 4 college	17 (14-23)	NA	36.6 mo (24-66)	5 thermal-assisted capsular shrinkage, 1 interval closure; none
Gerometta[16]; *Knee Surg Sports Traumatol Arthrosc*	2016	4	Arthroscopic Bankart	46[f]	30 recreational, 16 competitive (3 international, 8 national, 5 regional)	28.9 ± 8.1	37:9	24.4 ± 7.7 mo (12-35)	None; 1 revision
Gibson[17]; *Shoulder Elbow*	2016	4[b]	Arthroscopic Bankart	34[g]	All professional	23 (17-33)	All male	4.8 y (2-10)	None; None
Larrain[23]; *Arthroscopy*	2006	3	Arthroscopic Bankart	39[h]	NA	22 (16-35)	All male	5.7 y (3.3-8.3)	None; none
Garcia[15,i]; *Am J Sports Med*	2016	4	Arthroscopic Bankart with remplissage	44[j]	NA	29.8 (15.0-72.4)	NA	60.7 mo (25.5-97.6)	2 SLAP repairs; 4 Latarjet procedures and 2 "revisions"

[a]NA, not available; SLAP, superior labral anterior and posterior.
[b]Prospective.
[c]No. of participants by sport: contact—8 rugby, 6 judo, 5 soccer, 2 wrestling; overhead—11 baseball, 4 softball, 4 handball, 2 volleyball, 2 basketball, 1 badminton, 1 goalkeeping; noncollision/overhead—2 sprinting, 2 cross-country, 2 gymnastics, 1 rowing, 1 golf, 1 bowling.
[d]No. of participants by sport: 46 included; noncollision/nonoverhead—5 fitness sport, 2 mountain biking, 1 horseback riding, 1 tabletop soccer, 1 dancing; high-impact/collision sport—12 soccer, 1 American football; overhead sport—5 bodybuilding, 3 goalkeeper, 3 tennis, 2 basketball, 2 volleyball, 2 badminton, 1 underwater rugby, 2 handball; martial arts—2 judo, 1 wing tsun, 1 wrestling.
[e]No. of participants by sport: 13 football, 2 wrestling, and 3 soccer.
[f]No. of participants by sport: nonimpact (G1), 3 (6.5%); high impact (G2), 23 (50.0%); overhead (G3), 16 (34.8%); overhead with sudden stop (G4), 4 (8.7%).
[g]All soccer.
[h]Total, 190 patients; all rugby.
[i]Patients in this study underwent arthroscopic Bankart repair with remplissage procedure.
[j]No. of participants by sport: 50 total patients; athletes—1 rowing, 2 skiing, 2 wrestling, 2 cycling, 3 golf, 4 rock climbing, 4 volleyball, 4 hockey, 6 baseball, 8 softball, 8 football, 8 swimming, 16 weightlifting, 16 basketball, 20 running.

TABLE 3
Data for Included Latarjet-Type Procedure Studies

First Author; Journal	Year	Level of Evidence	Surgery Type	Athletes, n	Level of Athletics	Mean ± SD Age at Surgery (Range), y	Male: Female, n	Mean Follow-up, mo	Subsequent Procedures[a]
Colegate-Stone[10]; *Shoulder Elbow*	2015	4	Open; modified congruent arc Latarjet procedure	56[b]	6 professional, 50 regional-local level	24 (16-42)	50:6	12	1 revision due to broken screw
Neyton[27]; *J Shoulder Elbow Surg*	2012	4	Open; Latarjet-Patte procedure	34[c]	14 professional, 20 local level	23.4 (17-33)	All male	144	1 inferior screw removal
Cerciello[9]; *J Orthop Traumatol*	2012	4	Open; Latarjet procedure	26[d]	23 professional-semiprofessional, 3 recreational	21 (15-32)	All male	85	None
Bohu[4]; *Orthop Traumatol Surg Res*	2016	3	Minimally invasive Latarjet procedure	42[e]	14 professional, 20 competitive, 8 recreational	25.3 ± 6.4	41:5	18.5	None
Beranger[2]; *Eur J Orthop Surg Traumatol*	2016	4	Minimally invasive Bristow-Latarjet procedure	47[f]	29 recreational, 18 competitive	27.9 ± 7.9	46:1	46.8	None

[a]There were no concomitant procedures in any study.
[b]No. of participants by sport: 40 rugby (71%), 6 mountain biking (11%), 4 trail running (7%), 3 football (5%), 1 cricket (2%), 1 swimming (2%), 1 jujitsu (2%).
[c]All rugby.
[d]All soccer.
[e]Not available.
[f]No. of participants by sport: nonimpact (G1), 15 (32%); high impact (G2), 5 (32%); overhead (G3), 3 (6%); overhead with sudden stop (G4), 14 (30%).

included thermal capsulorrhaphy (10 patients), SLAP repair (2 patients), and rotator interval closure (6 patients).[15,20,24] These procedures did not significantly influence the RTS or reinjury rate, as the results from these studies were similar to those of the same surgical treatment. Note that there is no standard definition of RTS in

TABLE 4
Return-to-Sport Data[a]

First Author; Journal	Type of Surgery	RTS, n (%)	Return to Previous Level of Sports, n (%)	Mean ± SD RTS (Range), mo	Other Relevant Findings/Notes
Pavlik[29]; *Knee Surg Sports Traumatol Arthrosc*	Open Bankart	35 of 44 (79.5)	23 of 35 (65.7)	9.3 (4-16)	23 of 35 (65.7%) same level, 8 lower level (22.9%), 4 later gave up (11.4%)
Jobe[21]; *Am J Sports Med*	Open Bankart	25 of 25 (100)	18 of 25 (72)	14	7 no RTS: 1 professional pitcher lost velocity, 3 pitchers retired, 1 pitcher reoperated, 1 outfielder lost power, 1 high school pitcher noncompliant
Fabre[14]; *J Shoulder Elbow Surg*	Open Bankart	40 of 46 (87)	40 of 46 (87)	4.6 (2-8)	8 had redislocation; 20 RTS before 3 mo. Of these 20, 25% (5 of 20) had a recurrent dislocation; 3 of 26 (12%) who returned after 3 mo had a recurrent dislocation
Kjeldsen[22]; *Scand J Med Sci Sports*	Open Bankart	9 of 17 (53)	9 of 17 (53); 5 of 5 (100) elite athletes	4.4 (1.5-9)	11 Hill-Sachs lesions were identified before operation: 5, no RTS because of psychological reasons; 2, no RTS owing to pain; 2, no RTS because of lost power; 2, no RTS owing to recurrent dislocations
Beranger[2]; *Eur J Orthop Surg Traumatol*	Minimally invasive Bristow-Latarjet procedure	47 of 47 (100)	30 of 47 (64) same level; 10 of 47 (21.3) changed sport	6.3	Although all patients initially returned to sports, at the final follow-up, 2 stopped sports participation, 1 no longer had time for sports, and 1 was considered a surgical failure; 10 patients did change sports, and of these patients, 5 (50%) initially were involved in overhead or forced overhead sports.
Colegate-Stone[10]; *Shoulder Elbow*	Open; modified congruent arc Latarjet procedure	50 of 56 (89)	50 of 56 (89); 6 of 6 (100) professional	3.2	1 broken screw from a patient who returned to sports too early, 7% complication rate reported. Rugby patients took slightly longer to RTS at a mean 3.4 mo
Neyton[27]; *J Shoulder Elbow Surg*	Open; Latarjet-Patte procedure	22 of 34 (64.7)	19 of 34 (55.8) same level; 3 of 34 (8.8) less competitive, 22 of 34 (65) total	6	3 patients had a fracture of the bone block within 3 mo of surgery; 11 of 34 professional rugby players retuned to sports at a mean 4 mo. Patient participation in full training was at a mean 6 mo, and participation in competition was at a mean 7 mo.
Cerciello[9]; *J Orthop Traumatol*	Open; Latarjet procedure	25 of 26 (96.1)	18 of 26 (71.4) 7 of 25 (25) lower level, 1 of 26 (3.6) changed sport	8 (2-24)	1 redislocation with axillary nerve palsy
Bohu[4]; *Orthop Traumatol Surg Res*	Minimally invasive Latarjet procedure	37 of 42 (88.1)	28 of 37 (75.7)	5.3	5 patients changed sports, with 4 of 5 citing the operated shoulder as the main reason
Ide[20]; *Am J Sports Med*	Arthroscopic Bankart	54 of 55 (98.2)	44 of 55 (80)	7.1	5 poor results, 2 recurrent dislocations, 2 recurrent subluxations, 1 limited shoulder external rotation. Mean time to RTS by sport: contact, 4 mo; overhead, 8.1 mo; noncontact, 3.6 mo. Return to prior sports level by sport: contact, 18 of 21 (85.7%), overhead, 17 of 25 (68%), noncontact, 9 of 9 (100%)
Stein[31]; *Am J Sports Med*	Arthroscopic Bankart	43 of 46 (91.5)	NA[b]	6.5 ± 1 (5-9)	5 recurrent dislocations, 3 primary dislocations, and 1 subscapularis tendon rupture after surgery.
Mazzocca[24]; *Am J Sports Med*	Arthroscopic Bankart	18 of 18 (100)	18 of 18 (100)	5.7	2 of 18 (11%) recurrent instability (1 subluxation, 1 dislocation). Both recurrences were in collision athletes.
Gerometta[16]; *Knee Surg Sports Traumatol Arthrosc*	Arthroscopic Bankart	44 of 46 (95.7)	38 of 46 (82.6)	6.9 ± 4.1	1 redislocation, 1 adhesive capsulitis—both in G3 (overhead). It was reported that patient RTS was at a mean 6.9 mo, but there was delay to return to their preinjury levels, at a mean of 9.8 mo.
Gibson[17]; *Shoulder Elbow*	Arthroscopic Bankart	34 of 34 (100)	34 of 34 (100)	2.75 (2.25-3.5)	3 recurrent dislocations
Larrain[23]; *Arthroscopy*	Arthroscopic Bankart	39 of 39 (100)	39 of 39 (100)	5.3	2 cases of recurrence (5.1%) with traumatic episodes while playing rugby. Only 39 of the 190 patients were analyzed owing to a mixture of surgical interventions in the chronic instability group.
Garcia[15]; *Am J Sports Med*	Arthroscopic Bankart with remplissage	42 of 44 (95)	34 of 44 (77.3)	7	6 recurrent dislocations

[a]NA, not available; RTS, return to sport.
[b]Unable to quantify return to preinjury sports level owing to patients switching sports.

the peer-reviewed literature. Therefore, there is a spectrum of returning to sports ranging from being able to participate in limited athletic activity to being able to return to play at a presurgery or preinjury level. Authors appeared to define RTS as either being able to return to play or return to participation at the preinjury level. Few studies explicitly defined RTS, likely because data were self-reported in terms of returning to play or participating at preinjury levels.

The percentage RTS, the level at which the athletes returned, and the time for RTS were available in all included studies (Table 4). All studies had a mean follow-up time of at least 1 year, with most having ≥2 years. The data included in this study were representative of those of the last follow-up in each study. While it is possible that some patients were unable to continue sports after the final follow-up, the data compiled at that point showed that those who were able to achieve a RTS were able to do so consistently, with few patients needing subsequent procedures (Tables 1-4). In addition, 4 studies included time for RTS stratified across activity level.[2,10,20,23]

Overall, there was a high rate of RTS after all anterior shoulder stabilization procedures, with the highest among those athletes undergoing arthroscopic Bankart repair (97.5%), open Bankart (86.1%), open Latarjet (83.6%),

TABLE 5
Risk of Bias

First Author; Journal	Confounding	Selection of Participants	Classification of Interventions	Deviations From Intended Interventions	Missing Data	Measurement of Outcomes	Selection of Reported Result
Stein[31]; *Am J Sports Med*	High	Low	Low	Low	Some	Low	Low
Fabre[14]; *J Shoulder Elbow Surg*	High	Low	Low	Low	High	Low	Low
Kjeldsen[22]; *Scand J Med Sci Sports*	High	Unclear	Low	Low	Low	Low	Low
Beranger[2]; *Eur J Orthop Surg Traumatol*	Low	Low	Low	Low	Low	Low	Low
Gerometta[16]; *Knee Surg Sports Traumatol Arthrosc*	Low	Low	Low	Low	Low	Low	Low
Colegate-Stone[10]; *Shoulder Elbow*	High	Low	Low	Low	Low	Low	Low
Neyton[27]; *J Shoulder Elbow Surg*	High	Low	Low	Low	Low	Low	Low
Pavlik[29]; *Knee Surg Sports Traumatol Arthrosc*	Low	Unclear	Low	Low	Low	Low	Low
Ide[20]; *Am J Sports Med*	High	Low	Low	Low	Low	Low	Low
Jobe[21]; *Am J Sports Med*	Low	Low	Low	Low	Low	Low	Low
Mazzocca[24]; *Am J Sports Med*	Low	Low	Low	Low	Low	Low	Low
Cerciello[9]; *J Orthop Traumatol*	Low	Unclear	Low	Low	Low	Low	Low
Bohu[4]; *Orthop Traumatol Surg Res*	Low	Low	Low	Low	Low	Low	Low
Gibson[17]; *Shoulder Elbow*	High	Low	Low	Low	Low	Low	Low
Garcia[15]; *Am J Sports Med*	Low	Low	Low	Low	Low	Low	Low
Larrain[23]; *Arthroscopy*	Low	Low	High	Low	High	High	Low

minimally invasive Latarjet (94.0%), and arthroscopic Bankart with remplissage (95.5%). For those athletes who did RTS, the highest rate of return to preinjury levels was after arthroscopic Bankart repair (91.5%), followed by open Latarjet (90%), open Bankart repair (85.7%), arthroscopic Bankart with remplissage (81%), and minimally invasive or arthroscopic Latarjet (69.0%). Additionally, the mean time to RTS was similar among athletes after arthroscopic Bankart repair (5.9 months) and open and minimally invasive (arthroscopic) Latarjet (5.07 and 5.86 months) and longer after arthroscopic Bankart with remplissage (7 months) and open Bankart repair (8.21 months).

Tables 1 to 3 provide a summary of patient characteristics for the studies evaluating RTS data after anterior shoulder stabilization surgery. Additionally, Table 4 lists the rate and time to RTS for all studies; Table 5 summarizes study bias; and Table 6 provides a comparison of different anterior shoulder stabilization procedures with respect to RTS.

Quality

Table 5 summarizes the quality and resultant risk-of-bias assessment. Among 16 studies, 7 had some prevalence of bias attributed to confounding factors, likely the result of not having homogeneous patient populations. For example, in many studies, only a portion of the patient population reportedly had Hills-Sachs lesions, or only a few studies had athletes who played the same sport and at the same level. In these cases, this could have confounded the RTS data. Three of the 16 studies had bias because of missing data attributed to patients being lost to follow-up.

DISCUSSION

The purpose of this systematic review was to determine the rate and time to RTS among athletic populations after surgical stabilization for anterior shoulder instability and compare theses values according to the type of shoulder stabilization procedure. Overall, all procedures allowed a high rate of RTS participation, between 83.6% and 97.5%, with patients selected to undergo arthroscopic Bankart repair having the highest RTS rate (97.5%) (Table 6). The lowest RTS rate was seen in the open Latarjet group (83.6%); however, these patients had the fastest RTS, at a mean 5.1 months postoperatively. Interestingly, minimally invasive Latarjet procedures showed a longer mean time to RTS (5.9 months) when compared with open Latarjet. However, athletes who underwent arthroscopic Bankart repair were able to RTS at 5.9 months, as opposed to 8.2 months for open Bankart repair. Of all the surgical procedures examined, open Bankart repair had the longest mean time to RTS, although these data may be skewed by 1 study population of baseball pitchers who took significantly longer to RTS, at 14 months.[21] To our

TABLE 6
Comparison of Anterior Shoulder Stabilization Procedures With Respect to RTS[a]

	Athletes, n	Studies, n	RTS, % (n)	Return to Preinjury Level, % (n)		Mean RTS, mo
				Total Athletes	Athletes Who RTS	
Arthroscopic Bankart	238	6	97.5 (232)	90 (173 of 192)[b]	91.5 (173 of 189)[b]	5.9
Open Bankart	122	4	86.1 (105)	73.8 (90 of 122)	85.7 (90 of 105)	8.21
Open Latarjet procedure	116	3	83.6 (97)	75 (87 of 116)	90 (87 of 97)	5.07
Minimally invasive Latarjet	89	2	94 (84)	66.3 (58 of 89)	69 (58 of 84)	5.86
Arthroscopic Bankart with remplissage	44	1	95.5 (42)	77.3 (34 of 44)	81 (34 of 42)	7

[a]RTS, return to sport.
[b]Stein et al[31] study was excluded from "return to preinjury level" data.

knowledge, only 1 study assessed the RTS rate after arthroscopic Bankart repair with a concomitant remplissage procedure.[15] This study indicated a high rate of RTS (95.5%) at a mean 7 months after surgery.

Numerous studies demonstrated an unacceptably high rate of recurrent instability among athletes with anterior shoulder instability after nonoperative management, especially contact and collision athletes.[1,12,35] Therefore, anterior shoulder stabilization surgery is indicated to reduce recurrence rates and allow successful RTS. In a prospective multicenter observational study, Dickens et al[12] showed that nonoperative treatment of contact athletes resulted in a 73% RTS rate in the same season; however, only 27% of these patients were able to finish the season without a recurrence. This study was then followed by a prospective evaluation of the same population of military athletes, and the authors found a 90% RTS rate the season after arthroscopic Bankart repair.[13] Although the authors did not quantify the exact time in months to RTS, making it ineligible for our systematic review, this study does provide good evidence to support arthroscopic stabilization procedures allowing successful RTS without recurrent instability the following season within certain high-risk athletic populations (contact or collision sports). The findings of this review are in agreement with those of Dickens et al,[12,13] highlighting the value of the arthroscopic Bankart procedure among athletes with anterior shoulder instability, which allows for timely and successful RTS.

A number of recent studies cited higher recurrent instability with arthroscopic Bankart repair especially in the setting of young contact/collision athletes with subcritical or critical glenoid bone loss (>13.5%), which has led to expanding indications for bone augmentation techniques, such as Latarjet and open stabilization.[3,11,30,36] Additionally, this has led to increased use of the remplissage procedure to augment arthroscopic Bankart repairs among high-risk patients without significant glenoid bone loss. Despite findings of a lower recurrent instability rate with the Latarjet procedure, the RTS rate reported in the literature has been variable between arthroscopic Bankart repair and the Latarjet procedure. However, in our systematic review of pooled data, we found that arthroscopic Bankart and open Bankart repair had RTS rates of 97.5% and 86.1%, respectively. In the arthroscopic Latarjet and open Latarjet groups, the RTS rates were 94.0% and 83.6%, respectively. Interestingly, when we evaluated the group of athletes who did RTS, only 69.0% were able to return to preinjury levels after arthroscopic Latarjet, in contrast with 91.3% of athletes in the arthroscopic Bankart group. The open Bankart and open Latarjet groups had similar RTS rates at the preinjury level: 85.7% and 90%, respectively.

Although these pooled data provide valuable information for the physician and athlete on time and rate of RTS after anterior shoulder stabilization surgery, the studies are limited by selection bias and varying severity of soft tissue and glenoid/humeral bone loss within the patient populations, which would have dictated the type of surgical intervention. Given these reasons, it is difficult to conclude which type of surgery provides the best rate of RTS or time to RTS, as that decision is based on a number of factors, including glenoid bone loss, age of patient, type of sport, patient expectations, and so on. The purpose of this study was not to determine which type of surgery was the most successful or the most durable for RTS but to report the time to and rate of RTS for the various anterior shoulder stabilization procedures as a pooled cohort.

In a recent systematic review and meta-analysis of studies of RTS after anterior shoulder stabilization by Ialenti et al,[19] the authors found that patients consistently returned to their preinjury levels of play after arthroscopic Bankart repair (71%) and Latarjet (73%), though less often after open Bankart repair (66%). They found that the time to RTS was longer (8 months) for arthroscopic Bankart repair as compared with Latarjet or open Bankart (6 months). However, they noted in their results that only 8 of the 16 studies in their review had data available on time to RTS. In comparison, the value of the current systematic review is that only studies with information available for RTS and time to RTS were included for analysis. This allows for a more accurate interpretation of the current literature, with a homogeneous group on both the RTS rates and the time to RTS after anterior shoulder stabilization surgery.

Returning to sports in a timely fashion and being able to perform at a high level are priorities for athletes undergoing surgery. While an orthopaedic surgeon's responsibility is to assist in facilitating this, it is also the role of the surgeon to help set expectations for returning to sports participation. This is often difficult, as the time and ability to

RTS are based on a myriad of variables, including the individual's severity of injury, the type of sport (overhead, collision, contact, recreational), the level of the athlete, and the use of and compliance with the rehabilitation program.

An obvious limitation of this study is the inability to control for all these preoperative and patient variables. Additionally, a number of studies had diverse populations of athletes, including a mixed population of overhead and skill position athletes (eg, pitchers and baseball players) as well as a nonoverhead population with both noncontact and collision athletes. The heterogeneity in the study population is a major limitation to this systematic review. Furthermore, this study was limited by how each study defined RTS. Studies do not often define RTS, or they have variability in its definition. Given that there is no standardized definition, we suggest that future studies make efforts to standardize the definition of RTS, specifically with respect to the patient/athlete population, to better assist sports medicine specialists in setting expectations for their patients.

Although limited by these constraints, this systematic review provides valuable pooled data on the rate and time needed to RTS after surgery for anterior shoulder instability. The value of this study is to add more context in the shared decision-making process for treating athletes with anterior shoulder instability and to allow for more representative expectations for athletes looking to RTS at a high level in a timely manner. To expand from this review, future large prospective studies may be able to use it as a foundation to create a stronger framework in more accurately determining the rate and time to RTS for individual athletes after anterior shoulder stabilization surgery.

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