Sex-specific differences in outcomes after anterior shoulder surgical stabilization: a meta-analysis and systematic review of literature

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**Background:** Anterior shoulder instability frequently occurs in young, physically active individuals and may be treated with surgical stabilization. Previous studies have shown that males more often require surgical management for anterior shoulder instability and may have a higher frequency of recurrent instability episodes after surgical management, but females have been found to have increased incidence of apprehension after surgical stabilization. The purpose of this study is to review the literature and assess anterior shoulder surgical stabilization postoperative outcomes between males and females to identify and describe sex-based differences.

**Methods:** A systematic search of electronic databases was conducted to identify level I-IV clinical studies on anterior shoulder instability published between 1960 and August 2020. We included studies that evaluated sex-specific outcomes in patients who underwent anterior shoulder instability procedures. A meta-analysis of the data was performed to analyze sex-specific outcomes.

**Results:** Thirty studies (2.1%) met inclusion criteria, representing 9829 patients. Of the studies that reported the number of male and female patients, 74% were male and 26% were female. Twenty-six studies used Bankart repair alone, two used open Latarjet procedure alone, and two had a Bankart repair group and Latarjet procedure group. Instability recurrence, return to sport, and apprehension were included in the meta-analysis. Our meta-analysis demonstrated a significantly higher rate of instability recurrence for males than for females who underwent arthroscopic Bankart repair (risk ratio [RR] = 1.25; 95% confidence interval [CI] = 1.03, 1.52; \( P = .0239 \)). We did not identify a significant difference between males and females in rates of apprehension (RR = 0.68; 95% CI = 0.37, 1.27; \( P = .2300 \)) or return to sport (RR = 0.98; 95% CI = 0.81, 1.18; \( I^2 = 0\% \); \( P = .8110 \)) for arthroscopic Bankart repair or open Latarjet procedure.

**Conclusion:** For patients who underwent arthroscopic Bankart repair for anterior shoulder stabilization, recurrent rates of instability were significantly higher for males than for females. When open Bankart and Latarjet procedures were included, there was no difference. No difference was seen between males and females after arthroscopic Bankart repair or open Latarjet procedures with regard to return to sport or apprehension.

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Shoulder instability is a common problem in young, physically active individuals. Instability can be related to the shoulder’s wide range of motion (ROM), requiring muscle strength and coordination for stability. More than 95% of shoulder dislocations occur anteriorly, and recurrent anterior instability after the first dislocation has been estimated in up to 92% of cases with 7 years of follow-up. Recurrent shoulder instability after conservative management can be treated surgically, most often with arthroscopic or open Bankart repair. However, in cases with significant glenoid bone loss, procedures such as the modified Bristow-Latarjet coracoid transfer, or bone block autograft or allograft augmentation, can be used. When it comes to sex-specific outcomes after these shoulder stabilization procedures, previous studies have shown that males more often undergo surgical management than females. However, male sex may also be a contributing factor for recurrence of instability after surgical management. In contrast, Kaipel et al evaluated sex-related differences after arthroscopic shoulder stabilization and found females to have a lower Constant-Murley score and increased incidence of a positive apprehension test.
The underlying impact of sex on outcomes of anterior shoulder instability has been postulated to be due to differences between males and females in muscle forces on the shoulder, which are critical for maintaining proper articulation. The differences are believed to be the result of females having lower muscle mass than males, and therefore lacking balanced muscle forces required to maintain stability of the shoulder. Another possible cause for differences in outcomes between males and females could be the increased prevalence of hyperlaxity in females. However, other studies have shown that external factors, such as contact sports, may predispose males to instability as they may put themselves in positions that increase their risk of sustaining a shoulder dislocation compared with females.

Owing to this reported discrepancy in incidence and outcomes of shoulder instability between males and females, the purpose of this study was to review the current literature and to analyze sex-based differences in outcomes after anterior shoulder surgical stabilization.

Materials and methods

Search strategy and study selection

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were used to complete this systematic review and meta-analysis, and approval from the institutional review board was not required. An electronic database search was conducted using PubMed, Embase, PubMed Central, Ovid, and Cochrane Library. Search terms included “shoulder instability”, “Bankart repair”, “labral repair”, “Remplissage technique”, “Remplissage procedure”, “Latarjet technique”, “Latarjet procedure”, “Bristow technique”, “Bristow procedure”, “Bristow-Latarjet technique”, “Bristow-Latarjet procedure”, “Capsular shift”, “distal tibia allograft”, “distal clavicle autograft”, “iliac crest allograft”, “iliac crest autograft”, “male”, “female”, “gender”, and “sex”. Further references were obtained from identified review articles. Clinical studies with a level of evidence I-IV and a publication date between 1960 and August 21, 2020, were considered for inclusion.

Eligibility criteria

Studies that evaluated patients who underwent anterior shoulder instability operative repair, assessed sex-specific outcomes, and had a mean follow-up of at least one year were included. Only human clinical studies reported in the English language were considered for review. Case reports, review articles, and studies including concomitant biceps tenotomy or tenodesis or rotator cuff repair were excluded. Animal, cadaver, and laboratory-based studies were also excluded.

Data extraction and quality appraisal

Data related to sex-specific differences in outcomes were extracted from each study. The following data points were extracted from at least one study: failure/instability recurrence rate (which included rates of redislocation, subluxation, and/or requiring revision surgery, depending on the study), return-to-sport (RTS) rate, apprehension, sulcus sign, ROM, strength, maximum voluntary contraction, and validated outcome scores. In addition to evaluating instability recurrence and RTS rates, we also reviewed the definitions for instability recurrence and RTS and compared them across studies. Validated outcome scores included in this study were the Rowe score; Western Instruments score; Disabilities of the Arm, Shoulder, and Hand (DASH) score; Subjective Shoulder Value (SSV); Subjective Assessment of Shoulder Function (SASF); American Shoulder and Elbow Surgeons (ASES) evaluation form; and Constant-Murley score. The Rowe score is a rating system based on stability, motion, and function and is scored out of 100 points. The Western Ontario Shoulder Instability Index (WOSI) evaluates symptoms and different domains of function—sports, recreation, work, lifestyle, and emotional well-being. The WOSI score can be presented in a raw form—0 to 2,100, with 2,100 being the worst score—or converted to a percentage—0 to 100%, with 100% being the best possible score. The DASH assessment is a 30-item questionnaire that evaluates symptoms and functional status. The SSV is a subjective patient assessment scored as a percentage out of 100%. The SASF score is determined by asking the patient “How does your shoulder function in daily living and different physical activities?” and is also rated out of 100%. The ASES consists of a physician assessment (unscored) and patient evaluation and is scored out of 100 possible points. The Constant-Murley assessment includes 65 points for physical examination and 35 points for subjective patient evaluation. The quality of each study was assessed using the Tools to Assess Risk of Bias in Cohort Studies, Case Control Studies, and Randomized Controlled Trials by the CLARITY Group at the McMaster University. This tool is used as a guide to assess studies for bias due to the selection of cohorts, assessment of prognostic and outcome variables, and length of follow-up.

Statistical analysis

The random-effects model was used to determine pooled estimates of sex-based differences for failure/instability rates and RTS rates. Meta-analysis of the previously mentioned validated outcomes scores was not performed because of heterogeneity of reported study outcomes. An odds ratio and 95% confidence interval (CI) were calculated for each outcome evaluated. Heterogeneity was examined using the I² statistic. A total of 1412 studies were identified in the initial database search, of which 30 (2.1%) met inclusion criteria (Fig. 1). The characteristics of these studies are included in Table I. Of the 30 studies, 24 studies analyzed arthroscopic Bankart repair alone, and two studies compared arthroscopic Bankart and open Bankart repair. One study compared arthroscopic Bankart and open Latarjet procedure, and one study compared open Bankart repair and open Latarjet. and two studies analyzed only the open Latarjet procedure.

Patient demographics

The 30 studies represent 9829 patients; 74% male and 26% female among the studies that reported number of male and female patients. One study did not stratify the total number of patients according to sex but stratified the recurrence rate by sex. The mean age was not provided for every study but ranged from 15.7 ± 1 years to 37 ± 1 years among the 23 studies (8,777 patients) that reported mean age.

Quality bias assessment

A quality bias analysis was completed using the Tools to Assess Risk of Bias in Cohort Studies, Case Control Studies, and Randomized Controlled Trials by the CLARITY Group at the McMaster University, and the results of these analyses are displayed in Table II. Of
the studies included in this review, the levels of evidence were two level I studies, one level II study, nine level III studies, and eighteen level IV studies. Given that many of these studies were case series, there was a high level of bias associated with matching exposed and unexposed participants, as is indicated in Table II. However, the remainder of the bias analysis table indicates low levels of bias for the other categories of bias.

Functional outcomes

Instability recurrence, RTS, and apprehension were included in the meta-analysis. The definition of instability recurrence for each study is provided in Table III. Three studies defined instability recurrence as redislocation,\textsuperscript{1,8,15} 11 studies defined it as redlocation or subluxation,\textsuperscript{2,6,11,12,15,18,23–25,28,29,31,32,35,37–40,42,43} two studies defined it as needing revision surgery for instability,\textsuperscript{2,24} five studies defined it as “recurrent instability” (with no additional clarification),\textsuperscript{23,25,28,32,42} one study defined it as redislocation or revision surgery,\textsuperscript{43} and one study defined it as revisions, recurrences, and/or subluxations.\textsuperscript{18}

Twenty-three studies were included in the instability recurrence analysis for all procedural categories (arthroscopic Bankart repair, open Bankart repair, and open Latarjet procedures), representing 6858 males and 2423 females (Fig. 2).\textsuperscript{1,2,6–8,11,12,15,18,23–25,28,29,31,32,35,37–40,42,43} No significant difference was found in instability recurrence rate between males and females (risk ratio [RR] = 1.16; 95% CI = 0.85, 1.58; \( P = .3490 \)). There was a significantly high level of heterogeneity among the studies (\( I^2 = 71\% \)).

A subgroup analysis of studies using only arthroscopic Bankart repair was performed and included 21 studies representing 6858 males and 2423 females (Fig. 3).\textsuperscript{1,2,6–8,11,12,15,18,23–25,28,29,31,32,35,37–40,42,43} Males had a significantly higher rate of recurrence than females (RR = 1.25; 95% CI = 1.03, 1.52; \( P = .0239 \)). Heterogeneity between studies was low and not significant (\( I^2 = 18\% \)).

We were unable to perform a separate analysis of instability recurrence for open Bankart repair and open Latarjet procedural groups due to insufficient data. Two studies\textsuperscript{12,18} using open Bankart repair and one study\textsuperscript{18} using open Latarjet procedure reported instability recurrence rates, but did not report separate instability recurrence rates for males and females. The overall recurrence rate (for males and females combined) was reported by each study; 8% and 30% in the two open Bankart repair studies\textsuperscript{12,18} and 11% in the open Latarjet procedure study.\textsuperscript{18}
| First author | Year published | Study design | Level of evidence | Sex | Age* y | Procedure | Length of follow-up* mo |
|--------------|----------------|--------------|------------------|-----|--------|------------|------------------------|
| Aboalata     | 2017           | Case series  | IV                |     |        | Arthroscopic Bankart repair | —                      |
| Ahmed        | 2012           | Prospective cohort | Prognostic I |     |        | Arthroscopic Bankart repair | 24                    |
| Chan         | 2019           | Retrospective case-control | IV |     |        | Arthroscopic Bankart repair | 68.5                  |
| Cordasco     | 2020           | Case series  | IV                |     |        | Arthroscopic Bankart repair | 42.72                 |
| de Almeida Filho | 2012      | Case series  | IV                |     |        | Arthroscopic Bankart repair | 42.7                  |
| Finkikia     | 2010           | Case series  | IV                |     |        | Arthroscopic Bankart repair | 51                    |
| Gartsman     | 2000           | Case series  | IV                |     |        | Arthroscopic Bankart repair | 33                    |
| Gigi         | 2014           | Prospective cohort study | II |     |        | Arthroscopic Bankart repair | 204                   |
| Kaipel       | 2010           | Case series  | IV                |     |        | Arthroscopic Bankart repair | 58.65                 |
| Locher       | 2016           | Case series  | IV                |     |        | Arthroscopic Bankart repair | 22.4                  |
| Loppini      | 2019           | Retrospective case-control | III | 572 98 27 | Arthroscopic Bankart repair | 100.8                 |
| Mahure       | 2018           | Case series  | IV                | 4013 1706 24.9 | Arthroscopic Bankart repair | —                      |
| Martel       | 2016           | Case series  | IV                |     |        | Arthroscopic Bankart repair | 33                    |
| Nakagawa     | 2017           | Retrospective cohort | III | 214 43 | Arthroscopic Bankart repair | 55                    |
| Nakagawa     | 2017           | Retrospective case-control | III | 110 13 18.3 | Arthroscopic Bankart repair | —                      |
| Ozturk       | 2013           | Case series  | IV                |     |        | Arthroscopic Bankart repair | 27                    |
| Panzram      | 2020           | Case series  | IV                |     |        | Arthroscopic Bankart repair | 99.6                  |
| Robinson     | 2008           | Randomized controlled trial | Therapeutic I | 82 6 | Arthroscopic Bankart repair | —                      |
| Sommaire     | 2012           | Retrospective cohort | III | 54 23 27.48 | Arthroscopic Bankart repair | 44.4                  |
| Szylik       | 2015           | Case series  | IV                |     |        | Arthroscopic Bankart repair | 98.4                  |
| Thal         | 2007           | Case series  | IV                |     |        | Arthroscopic Bankart repair | —                     |
| Vermeulen    | 2019           | Case series  | IV                |     |        | Arthroscopic Bankart repair | 75.6                  |
| Yamamoto     | 2019           | Retrospective cohort | III | 30 13 26 | Arthroscopic Bankart repair | 32                    |
| Yian         | 2020           | Retrospective cohort | III | 281 56 | Arthroscopic Bankart repair | 74.4                  |
| Augustsson   | 2012           | Prospective cohort | III | 24 7 | Arthroscopic Bankart repair | 84                    |
| Flint        | 2018           | Case series  | IV                |     |        | Arthroscopic Bankart repair | —                     |
| Zimmerman    | 2016           | Retrospective cohort | Therapeutic III | 184 87 28.2 | Arthroscopic Bankart repair | —                     |
| Hovelius     | 2011           | Retrospective case-control | III | 82 11 30.8 | Open Latarjet procedure | —                     |
| Domos        | 2020           | Case series  | IV                |     |        | Open Latarjet procedure | 79.2                  |
| Privitera    | 2018           | Case series  | IV                |     |        | Open Latarjet procedure | 52                    |

Figure 2 Instability recurrence for males and females for arthroscopic Bankart repair, open Bankart repair, and open Latarjet procedure.
Table II
Tools to assess risk of bias cohort studies.

| Study                        | Year | Year | 1. Was the allocation sequence adequately generated? | 2. Was the allocation adequately concealed? | 3. Were the cases (those who were exposed to the intervention) properly selected? | 4. Were the controls (those who were exposed to the control) properly selected? | 5. Were cases and controls matched according to important prognostic variables or was statistical adjustment carried out for those variables? |
|-----------------------------|------|------|---------------------------------------------------|------------------------------------------|--------------------------------------------------------------------------------|------------------------------------------|--------------------------------------------------------------------------------|
| Abrolata et al⁴                | 2016 | N/A  | Definitely yes                                    | Definitely yes                           | Definitely yes                                                                  | Definitely yes                           | definitely yes                                                                  |
| Ahmed et al⁵                  | 2012 | N/A  | Definitely yes                                    | Definitely yes                           | Definitely no                                                                   | Definitely no                            | definitely no                                                                  |
| Augustsson et al⁶             | 2019 | N/A  | Definitely yes                                    | Definitely yes                           | Probably no                                                                     | Definitely no                            | probably no                                                                    |
| Cordasco et al⁷               | 2020 | N/A  | Definitely yes                                    | Definitely yes                           | Probably yes                                                                    | Definitely yes                           | probably yes                                                                    |
| de Almeida et al⁸             | 2012 | N/A  | Definitely yes                                    | Definitely yes                           | Probably no                                                                     | Definitely no                            | probably no                                                                    |
| Domos et al⁹                  | 2020 | N/A  | Definitely yes                                    | Definitely yes                           | Definitely no                                                                   | Definitely no                            | probably no                                                                    |
| Flinkkilä et al¹⁰             | 2010 | N/A  | Definitely yes                                    | Definitely yes                           | Definitely no                                                                   | Definitely no                            | probably no                                                                    |
| Flint et al²                  | 2018 | N/A  | Definitely yes                                    | Definitely yes                           | Definitely no                                                                   | Definitely no                            | probably no                                                                    |
| Gartsman et al¹³              | 2000 | N/A  | Definitely yes                                    | Definitely yes                           | Definitely no                                                                   | Definitely no                            | probably no                                                                    |
| Gigs et al¹⁴                  | 2014 | N/A  | Definitely yes                                    | Definitely yes                           | Definitely no                                                                   | Definitely no                            | probably no                                                                    |
| Kaipel et al²⁰                | 2010 | N/A  | Definitely yes                                    | Definitely yes                           | Definitely no                                                                   | Definitely no                            | probably no                                                                    |
| Locher et al²²                | 2016 | N/A  | Definitely yes                                    | Definitely yes                           | Definitely no                                                                   | Definitely no                            | probably no                                                                    |
| Mahure et al²³                | 2018 | N/A  | Definitely yes                                    | Definitely yes                           | Definitely no                                                                   | Definitely no                            | probably no                                                                    |
| Martel et al²⁴                | 2016 | N/A  | Definitely yes                                    | Definitely yes                           | Definitely no                                                                   | Definitely no                            | probably no                                                                    |
| Nakagawa et al²⁸              | 2017 | N/A  | Definitely yes                                    | Definitely yes                           | Definitely no                                                                   | Definitely no                            | probably no                                                                    |
| Oztürk et al²⁹                | 2013 | N/A  | Definitely yes                                    | Definitely yes                           | Definitely no                                                                   | Definitely no                            | probably no                                                                    |
| Panzram et al¹⁰               | 2020 | N/A  | Definitely yes                                    | Definitely yes                           | Definitely no                                                                   | Definitely no                            | probably no                                                                    |
| Privitera et al¹⁰             | 2018 | N/A  | Definitely yes                                    | Definitely yes                           | Definitely no                                                                   | Definitely no                            | probably no                                                                    |
| Sommaire et al¹²              | 2012 | N/A  | Definitely yes                                    | Definitely yes                           | Definitely no                                                                   | Definitely no                            | probably no                                                                    |
| Szyluk et al²⁰                | 2015 | N/A  | Definitely yes                                    | Definitely yes                           | Definitely no                                                                   | Definitely no                            | probably no                                                                    |
| Vermeulen et al¹⁰             | 2019 | N/A  | Definitely yes                                    | Definitely yes                           | Definitely no                                                                   | Definitely no                            | probably no                                                                    |
| Yamamoto et al¹¹              | 2019 | Open Latarjet procedure | Definitely yes                           | Definitely yes                           | Definitely yes                                                                   | Definitely no                            | probably no                                                                    |
| Yian et al¹²                  | 2020 | N/A  | Definitely yes                                    | Definitely yes                           | Definitely no                                                                   | Definitely no                            | probably no                                                                    |
| Zimmerman et al¹³            | 2016 | N/A  | Definitely yes                                    | Definitely yes                           | Definitely no                                                                   | Definitely no                            | probably no                                                                    |

Three studies were included for the RTS analysis, representing 130 males and 34 females (Table IV, Fig. 4). Gigs et al did not state how RTS was determined for their study.¹⁵ Privitera et al defined RTS as returning to original sport at preinjury level or decreased level of competition.²¹ Oztürk et al reported RTS as return to preinjury level of sports activity or return to less competitive activities.³¹ The number of individuals who participated in contact and noncontact or limited-contact sports is also listed in Table IV. The classification of contact and noncontact or limited-contact sports comes from The American Academy of Pediatrics.³⁴ No significant difference in RTS rate was found between males and females (RR = 0.98; 95% CI = 0.81, 1.18; I² = 0%; P = .8110). Postoperative rates of apprehension for males and females were reported in three studies and represented 74 males and 45 females.
Bankart repair and open Latarjet procedure. We did not difference between males and females when including the open scores are included in Table V. Table V contains male and female heterogeneity in the results reported in each study, but outcomes been found to have better outcomes for contact athletes. 26 together is the inclusion of the open Latarjet procedure, which has signi

Outcome scores and physical examination findings were not included in the statistical meta-analysis because of significant heterogeneity in the results reported in each study, but outcomes scores are included in Table V. Table V contains male and female outcome scores for the shoulder functional assessment tools: Rowe, WOSI, DASH, SSV, SASF, ASES, and Constant–Murley. Only one study reported sex-stratified physical examination findings (maximum voluntary contraction, strength, and ROM), and as such, we have not included the data in this analysis. 3

Discussion

In this systematic review and meta-analysis of anterior shoulder surgical stabilization postoperative outcomes between males and females, we analyzed instability recurrence, RTS, and apprehension. We found males to have a higher rate of instability recurrence than females after arthroscopic Bankart repair, which is consistent with what was previously reported in the literature. 2 Arthroscopic Bankart repair was the only procedural category that could be analyzed individually for instability recurrence in the meta-analysis because of the limited availability of studies and sex-specific data for open Bankart repair and open Latarjet procedure. An analysis of instability recurrence for all procedural categories grouped together was able to be performed, and there was no significant difference between males and females when including the open Bankart repair and open Latarjet procedure. We did not find a significant difference between males and females in terms of apprehension or RTS rates for arthroscopic Bankart repair and open Latarjet procedure studies. One possible explanation for the lack of significant difference when all procedural categories were grouped together is the inclusion of the open Latarjet procedure, which has been found to have better outcomes for contact athletes. 20 Although none of the studies of contact vs. noncontact athletes reported the percentage of males and females within each category (contact vs. noncontact), if more males were included in the contact sports category, it would follow that they would have better outcomes when undergoing the open Latarjet procedure.

Instability recurrence was defined differently across the 23 studies that reported this outcome, making interstudy analysis less reliable and generalizable. Three studies defined instability recurrence as redislocation, 14,15 11 studies defined it as redislocation or subluxation,2,6,11,12,30,31,36–40 two studies defined it as needing revision surgery for instability,22,24 five studies defined it as “recurrent instability,”21,25,28,32,42 one study defined it as redislocation or revision surgery,43 and one study defined it as revisions, recurrences, and/or subluxations. 18 These varying definitions of recurrent instability create a wide umbrella under which we include various types of failure after surgery and make it difficult to determine the true success and failure rates of procedures. These definitions of recurrence also do not address failure of the procedure in terms beyond instability—such as return to activity—which raises questions about the value of the definition of recurrence or failure. In order to better assess failure/instability recurrence in future studies, a standard definition for failure/instability recurrence should be established and used when assessing patients during the follow-up period. It would also add to the strength of these studies to subcategorize surgical procedures based on intraoperative variations to ensure equivalent procedures are being compared.

The RTS and apprehension analyses only included three studies, representing a small sample of patients. The limited number of studies and participants increases the risk for bias. In addition, the definition of RTS was only reported in two of these studies, and the definition varied between the two. 3,13 Privitera et al 33 considered RTS as patients returning to their original sport, while Ozturk et al 31 considered RTS as returning to any sports activity. These studies also did not clearly differentiate levels of activity (contact vs. noncontact) for males and females, making it difficult to compare males and females in terms of RTS. An additional consideration with the apprehension analysis is the lack of explicit definition for apprehension as well as the variability in apprehension determination based on the examiner. All these factors combined elucidate

(Fig. 5). 9,15,20 Analysis of reported apprehension revealed no significant difference in the rate of apprehension between males and females (RR = 0.68; 95% CI = 0.37, 1.27; P = .2300). Significant heterogeneity was found between the studies ($I^2 = 79\%$).

Instability recurrence was defined differently across the 23 studies that reported this outcome, making interstudy analysis less reliable and generalizable. Three studies defined instability recurrence as redislocation, 14,15 11 studies defined it as redislocation or subluxation,2,6,11,12,30,31,36–40 two studies defined it as needing revision surgery for instability,22,24 five studies defined it as “recurrent instability,”21,25,28,32,42 one study defined it as redislocation or revision surgery,43 and one study defined it as revisions, recurrences, and/or subluxations. 18 These varying definitions of recurrent instability create a wide umbrella under which we include various types of failure after surgery and make it difficult to determine the true success and failure rates of procedures. These definitions of recurrence also do not address failure of the procedure in terms beyond instability—such as return to activity—which raises questions about the value of the definition of recurrence or failure. In order to better assess failure/instability recurrence in future studies, a standard definition for failure/instability recurrence should be established and used when assessing patients during the follow-up period. It would also add to the strength of these studies to subcategorize surgical procedures based on intraoperative variations to ensure equivalent procedures are being compared.

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Table III
Instability recurrence rate and definition of instability recurrence for arthroscopic Bankart repair, open Bankart repair, and open Latarjet procedure.

| Author                        | Procedure                        | Instability recurrence rate, n (%) | Definition of failure/instability recurrence |
|-------------------------------|----------------------------------|-----------------------------------|---------------------------------------------|
|                               |                                  | Male | Female |                          |                                    |
| Arthroscopic Bankart          |                                  |      |        |                          |                                    |
| Aboalata et al1               | Arthroscopic Bankart repair       | 22/107 (21) | 4/107 (11) | Redislocation               |
| Ahmed et al2                  | Arthroscopic Bankart repair       | 37/265 (14) | 3/37 (8) | Redislocation or subluxation |
| Chan et al9                   | Arthroscopic Bankart repair       | 28/119 (24) | 6/12 (50) | Redislocation or subluxation |
| Cordasco et al7               | Arthroscopic Bankart repair       | 4/48 (8) | 0/19 (0) | Revision surgery for instability |
| de Almeida Filho et al8       | Arthroscopic Bankart repair       | 8/42 (19) | 0/7 (0) | Redislocation               |
| Finkkila et al11              | Arthroscopic Bankart repair       | 27/132 (20) | 6/50 (12) | Redislocation or subluxation |
| Gigis et al13                 | Arthroscopic Bankart repair       | 3/24 (13) | 2/14 (14) | Redislocation               |
| Loppi et al11                 | Arthroscopic Bankart repair       | 100/572 (17) | 14/98 (14) | Recurrent instability |
| Mahure et al24                | Arthroscopic Bankart repair       | 340/4013 (9) | 121/1706 (7) | Revision surgery for instability |
| Martel et al25                | Arthroscopic Bankart repair       | 8/43 (19) | 1/4 (25) | Recurrence instability      |
| Nakagawa et al29              | Arthroscopic Bankart repair       | 37/214 (17) | 5/43 (12) | Recurrent instability       |
| Nakagawa et al29              | Arthroscopic Bankart repair       | 21/110 (19) | 2/13 (15) | Redislocation or subluxation |
| Ozturk et al31                | Arthroscopic Bankart repair       | 4/42 (10) | 1/11 (9) | Redislocation or subluxation |
| Panzram et al12               | Arthroscopic Bankart repair       | 16/76 (21) | 6/24 (25) | Recurrent instability       |
| Robinson et al21              | Arthroscopic Bankart repair       | 19/82 (23) | 0/6 (0) | Redislocation or subluxation |
| Sommaire et al17              | Arthroscopic Bankart repair       | 9/54 (17) | 3/23 (13) | Redislocation or subluxation |
| Szylik et al15                | Arthroscopic Bankart repair       | 6/74 (8) | 3/18 (17) | Redislocation or subluxation |
| Thal et al29                  | Arthroscopic Bankart repair       | 5/57 (9) | 0/15 (0) | Redislocation or subluxation |
| Vermeulen et al10             | Arthroscopic Bankart repair       | 28/112 (25) | 5/35 (14) | Redislocation or subluxation |
| Yian et al42                  | Arthroscopic Bankart repair       | 90/281 (32) | 12/56 (21) | Recurrence instability      |
| Zimmerman et al43            | Arthroscopic Bankart repair       | 68/184 (37) | 25/87 (29) | Redislocation or revision surgery |
| Arthroscopic and open Bankart |                                  |      |        |                          |                                    |
| Flint et al12                 | Arthroscopic Bankart repair       | 17/57 (30) | 3/3 (100) | Redislocation or subluxation |
| Open Bankart and open Latarjet| Hovelius et al18                 | Open Bankart repair | 32/150 (21) | 6/35 (17) | Revisions, recurrences, and/or subluxations |

Table IV
Return to sport according to sex, contact level, participation level, and definition of RTS.

| Author                        | Procedure                        | Athlete type, n (%) | Participation level | Definition of RTS | RTS, n (%) |
|-------------------------------|----------------------------------|---------------------|---------------------|------------------|------------|
|                               |                                  | Male | Female | Contact | Non-contact/Limited contact | Competitive level | - | Male | Female |
| Gigis et al15                 | Arthroscopic Bankart repair       | 9 (33) | 18 (67) | Professional: 6 | - | Professional level: 20 (27) | Return to preinjury level of sports activity return to less competitive activities Return to original sport at preinjury level or decreased level of competition | 17/24 (71) | 8/14 (57) |
| Ozturk et al31                | Arthroscopic Bankart repair       | 22 (42) | 31 (58) | Collegiate: 15 | - | High school: 10 | Return to preinjury level of sports activity or return to less competitive activities Return to original sport at preinjury level or decreased level of competition | 36/42 (86) | 10/11 (89) |
| Privitera et al13             | Open Latarjet procedure          | 64 (88) | 9 (12) | Professional or semiprofessional level: 3 (4) | - | Professional level: 20 (27) | Return to preinjury level of sports activity or return to less competitive activities Return to original sport at preinjury level or decreased level of competition | 40/64 (63) | 6/9 (67) |

RTS, return to sport.
a need for more accurate and consistent reporting of RTS and apprehension for the sake of future studies.

This review contributes to the literature in several ways. Our analysis suggests that males have higher rates of recurrent instability after arthroscopic Bankart repair, but it is unknown whether open Bankart repair has better outcomes for males because there are currently not enough studies available for sex-specific analysis of this procedure. This calls attention to the need for more studies of open Bankart repair that take patient sex into consideration when assessing outcomes; however, open Bankart repair has recently been shown to have less favorable outcomes overall than arthroscopic Bankart repair and may fall out of favor as a result. This review also highlights the need for more studies that would benefit from more equal ratios of males and females. Finally, this study was limited by the lack of sex-stratified outcomes within studies and resultant inability to compare these data between studies. Furthermore, outcomes within these studies were heterogeneous. Seven different functional assessment tools were used, and many studies did not use the same tools, resulting in data that could not be analyzed between studies.

Conclusion

For patients who underwent arthroscopic Bankart repair for anterior shoulder stabilization, recurrent rates of instability were significantly higher for males than for females. When open Bankart and Latarjet procedures were included, there was no difference. No difference was seen between males and females after arthroscopic Bankart repair or open Latarjet procedures with regard to RTS or apprehension.

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