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SHOULDER

# Low rate of recurrent instability following the open Latarjet procedure as a revision procedure for failed prior stabilization surgery

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## Abstract

**Purpose** The purpose of this study is to systematically review the literature to ascertain functional outcomes, recurrence rates and subsequent revision rates following the open Latarjet procedure when performed as a revision procedure.

**Methods** Two independent reviewers performed the literature search based on PRISMA guidelines, utilizing the EMBASE, MEDLINE, and The Cochrane Library Databases. Studies where the Latarjet procedure was performed as a revision procedure were included. Clinical outcomes analyzed were: (1) functional outcomes, (2) recurrent instability, (3) revisions, and (4) complications.

**Results** The review found 16 studies with 713 shoulders that met the inclusion criteria. 605 of the patients were male (84.9%), with an average age of 28.2 years (15–62) and follow-up of 47.7 months. The most commonly reported functional outcome measure was the Rowe score, with a weighted mean of 92.7. 86/95 patients had good–excellent outcomes (90.4%). 136/143 patients reported return to play (95.1%). 141/161 patients returned to the same level of competition (87.6%). 50 patients experienced recurrence (8.4%). Five patients experienced redislocation (0.9%) and 37 patients experienced subluxation (6.7%). There were 29 revisions (5.1%), with 12 revisions due to recurrence (2.1%). There were 68 total complications, not including recurrence (11%). The most common complications were 13 cases of nerve damage and infection respectively (2.1%). There was 17 cases of new instability arthropathy (6.5%), and 31 cases of residual pain (6.7%).

**Conclusion** This review shows that the revision Latarjet provides excellent functional outcomes, low rates of recurrence and complications, and a high rate of return to sport among athletes. This results from study can be used to explain the expected outcomes associated with the Latarjet procedure performed as a revision.

**Level of evidence** IV.

**Keywords** Latarjet · Anterior shoulder instability · Systematic review · Revision

## Introduction

Anterior shoulder instability is common and most commonly occurs in young athletes and military personnel [18]. The arthroscopic Bankart repair is the most commonly used procedure in surgical management of anterior shoulder instability [11, 13, 35]. However, studies with long-term follow-up of the arthroscopic Bankart repair have demonstrated that recurrence remains a challenging clinical problem with rates ranging from 20 to 40% [7, 34]. In a classic study, Burkhart and De Beer found that the rate of failure following an arthroscopic Bankart repair was 67% in patients with significant bone loss compared to 4.9% in those without significant bone loss [6]. When needed, arthroscopic revision stabilization surgery can be challenging with less predictable results. For example, Abouali et al. found in a systematic review that revision arthroscopic Bankart repair had a recurrence rate of 14.2%, with glenohumeral bone loss, hyperlaxity, and return to contact sports as significant risk factors for recurrence [1].

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The Latarjet procedure is often utilized in the setting of a prior failed shoulder stabilization procedure particularly when clinically relevant glenoid bone loss is present [36]. There are concerns regarding the extensive utilization of the Latarjet procedure as a primary surgical option due to its non-anatomical nature and relatively high rate of complications [12, 20, 21]. However, when performed correctly the Latarjet is a reliable option in the case of patients with failed previous surgery as it offers a lower recurrence rate than arthroscopic or open Bankart repairs [2, 23, 24]. Traditionally, the Latarjet procedure is performed by an open approach though recent literature shows comparable outcomes when performed arthroscopically [21, 27, 28, 30, 34].

The outcomes of the Latarjet procedure when performed as a revision procedure for failed prior anterior instability surgery have not previously been systematically reviewed to date. Therefore, this study aims to systematically review the literature to assess the functional outcomes, return to play rates, recurrence rates, complication rates and further revision rates following the open Latarjet as a revision procedure for failed prior anterior instability surgery. This study aims to provide guidance to surgeons by showing the outcomes associated with performing the Latarjet as a revision procedure. It was hypothesized that the Latarjet procedure as a revision procedure for failed prior anterior instability surgery would provide good functional outcomes, with low complication rates, recurrence rates and subsequent revision rates.

## Materials and methods

### Study selection

Two authors performed the literature search and review was performed by using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [29]. The senior author served as an arbitrator on points of disagreement between the two authors. The reviewers screened the title and abstract of papers identified in the search and eligible studies received a full-text review.

### Search strategy

The study used the seach algorithm: (anterior shoulder instability or shoulder instability) AND (Latarjet OR open Latarjet OR arthroscopic Latarjet OR Latarjet procedure OR Bristow OR open Bristow OR Bristow procedure OR Bristow-Latarjet OR coracoid transfer) in MEDLINE, EMBASE, and The Cochrane Library, databases in April 2020, with no time limit given to the publication date.

### Eligibility criteria

Inclusion criteria included: (1) clinical study on the open Latarjet procedure, (2) stated number of patients with previous shoulder surgery, (3) published in a peer-reviewed journal, and (4) published in English.

The exclusion criteria included: (1) review studies, (2) cadaver studies, (3) biomechanical studies, (4) abstract only, (5) no stated patients with previous shoulder surgery, and (6) no data separation between patients with an open Latarjet procedure performed as a primary procedure or as revision procedure following failed prior anterior shoulder instability surgery.

### Data extraction/analysis

Two blinded reviewers used a predetermined data sheet to record relevant information regarding the study characteristics including the study design, the level of evidence (LOE), the methodological quality of evidence (MQOE), population, clinical outcome measures, and the follow-up time. A third independent reviewer compared the aggregated results.

The LOE was evaluated based on the guidelines by the Oxford Centre for Evidence-Based Medicine and the MQOE was evaluated using a Modified Coleman methodology score [20]. Studies were considered to be of excellent quality if they scored 85–100, good quality if they scored 70–84, fair quality if they scored 55–69, and poor quality if they scored less than 55. The clinical outcomes extracted and analyzed were (1) functional outcomes, (2) recurrent instability, (3) revisions, and (4) complications. Authors were contacted in cases where papers may have had relevant information that was not available in the text. Functional outcomes were included if they were reported by more than one study.

### Statistical analysis

Statistical analysis was performed using SPSS (IBM Corp. Released 2013. IBM SPSS Statistics for Macintosh, Version 22.0. Armonk, NY: IBM Corp.). Quantitative analysis was performed for each study, the results in the included studies were pooled and the overall rates were calculated.

## Results

### Literature search

The initial search resulted in 962 total studies. After screening for duplicates, inclusion, and exclusion criteria, 518

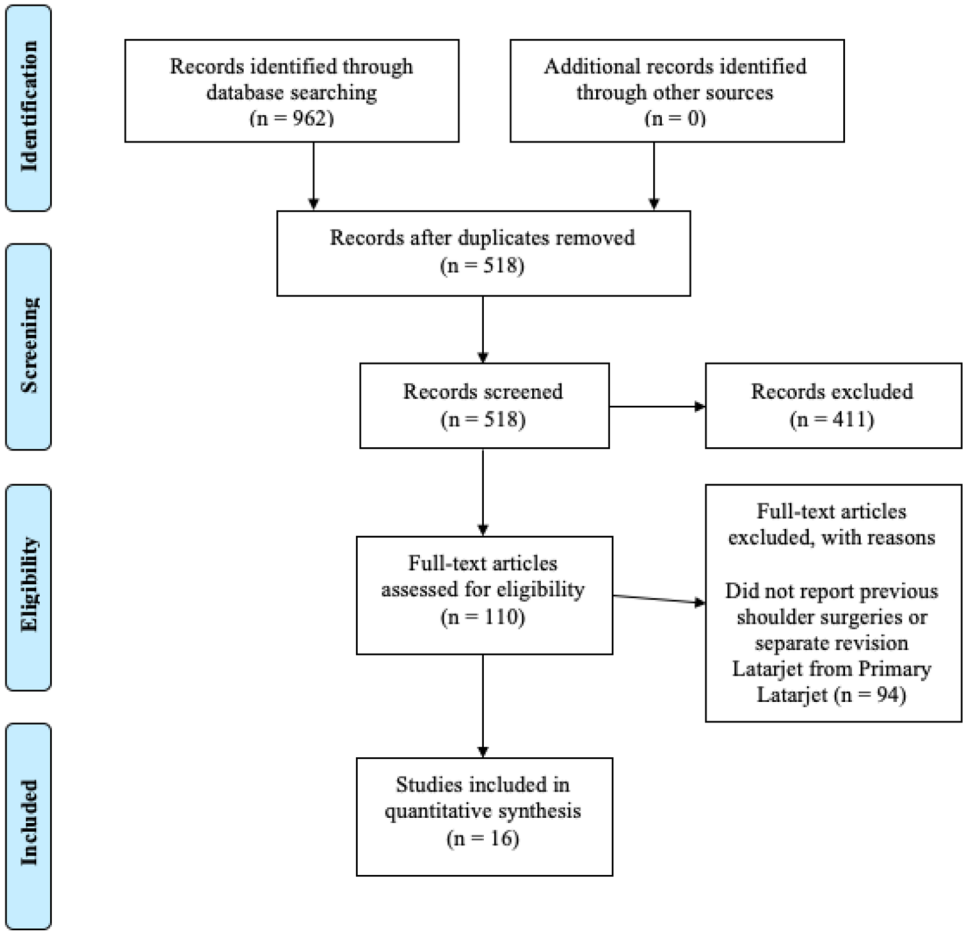


**Fig. 1** PRISMA diagram

studies were evaluated and full texts were assessed for eligibility. After the inclusion and exclusion criteria were applied, 16 eligible studies with 713 shoulders were included for analysis in this systematic review (Fig. 1).

## Patient demographics

There were 16 studies with 713 shoulders included; 13 were retrospective, and three were prospective [5, 8, 14–17, 19, 22, 31, 32, 37, 38, 40, 41, 43, 44]. The mean MQOE was 65.5 (56–77). 84.9% of the patients were male and 15.1% were females. The average patient was 28.2 years old (15–62 years) and the mean follow-up was 47.7 months (3–192 months). Patient demographics are presented in Table 1.

## Functional outcomes and return to play

The most commonly reported functional outcomes were the Rowe score, and the Subjective Shoulder Value (SSV), and the Western Ontario Shoulder Index (WOSI), having all been reported in five studies. The Rowe score had a weighted mean of 92.7 ($n = 178$, 85–96.8), with 90.4% of patients having good–excellent outcomes [5, 8, 31, 37, 38]. The weighted mean SSV score was 78.4% ($n = 205$, 68–84.9%) [14, 15, 22, 31, 40]. The mean WOSI score was 75.8 ($n = 188$, 74.3–83.9%) [14, 15, 22, 31, 44]. Other outcomes that were reported by multiple studies are listed in Table 2.

Five studies reported on athletes return to play (RTP) [5, 31, 37, 38, 43]. In these studies, only seven patients did not return to sport (136/143, 95.1%). Out of the 161 patients returning to sport, 131 returned to at least the same level of competition as prior to the procedure (87.6%). Five athletes reported reasons for not returning to the same level of sport. Two changed sport citing fear of re-injury [37]. The remaining three reported their reason as decreased performance in their sport, despite having good functional scores [38].

## Recurrent instability

Recurrent instability was reported in 15 out of 16 studies, with data available for 592 shoulders [5, 8, 14–17, 22, 31, 32, 37, 38, 40, 41, 43, 44]. There were 50 cases of recurrent

**Table 1** Study characteristics and patient demographics

| Authors | *N* shoulders | LOE | Pro/retro | MQCE | Male | Age (years) | Follow-up (months) |
|---|---|---|---|---|---|---|---|
| Bonnevialle et al. 2012 | 6 | IV | Retro | 62 | 81.8 (%) | 33.3 (20–45) | 47 |
| Chaudhary et al. 2015 | 24 | IV | Pro | 77 | 23 | 31.8 (21–37) | 26 |
| Flinkkila et al. 2014 | 52 | IV | Retro | 66 | 45 | 28.4 (17–62) | 38 |
| Flinkkila et al. 2019 | 52 | IV | Retro | 59 | 42 | 33 (25–41) | 55.2 |
| Frank et al. 2018 | 32 | IV | Pro | 71 | 96 (%) | 25.4 (19–32) | >48 |
| Frank et al. 2019 | 92 | IV | Retro | 65 | 69 | 28.5 (17–40) | 3 |
| Gartsmann et al. 2017 | 121 | IV | Retro | 52 | N/R | 29.6 (22–37) | 7.8 |
| Hovelius et al. 2012 | 23 | IV | Retro | 69 | 83.7 (%) | 27.4 (15–57) | 192 |
| Minkus et al. 2019 | 29 | IV | Pro | 69 | 25 | 27 (18–42) | 27 |
| Mook et al. 2016 | 25 | V | Retro | 67 | 21 | 25.4 (16–43) | 41 |
| Ranaletta et al. 2018 | 65 | IV | Retro | 69 | 63 | 26.8 (17–35) | 44 |
| Rossi et al. 2018 | 54 | III | Retro | 69 | 52 | 27.3 (17–50) | 58 |
| Schmid et al. 2012 | 49 | IV | Retro | 56 | 37 | 29 (15–54) | 38 |
| Shah et al. 2012 | 35 | IV | Retro | 59 | 81.3 (%) | 30 (15–60) | 9.4 |
| Werthel et al. 2020 | 20 | III | Retro | 69 | 15 | 28.9 (18–38) | 43.2 |
| Yang et al. 2016 | 34 | III | Retro | 69 | 78.8 (%) | 23.2 (16–30) | 42 |

*LOE* level of evidence, *MQOE* methodological quality of evidence, *N/R* not reported

**Table 2** Functional outcomes and return to play

| Outcome | Studies | Result (*N*) |
|---|---|---|
| Total RTP | 4 | 95.1% (143) |
| RTP same/higher level | 5 | 87.6 (161) |
| Constant | 2 | 86.8 (65) |
| Rowe | 5 | 92.7 (178) |
| SANE | 2 | 85.0 (59) |
| SSV | 5 | 78.4 (205) |
| Walch-Duplay | 2 | 73.3 (47) |
| WOSI | 5 | 75.8 (188) |
| VAS | 4 | 1.6 (173) |
| Good/excellent outcomes | 3 | 90.4 (95) |
| Satisfaction | 3 | 94.3 (53) |

*N* number, *RTP* return to play, *SANE* single assessment numeric evaluation, *SSV* subjective shoulder value, *WOSI* Western Ontario Shoulder Index, *VAS* Visual Analogue Scale

**Table 3** Recurrent instability

| Outcome | Studies | Result (*N*) |
|---|---|---|
| Total recurrence | 15 | 8.4% (50/592) |
| Redislocations | 13 | 0.9% (5/547) |
| Subluxations | 13 | 6.7% (37/547) |
| Apprehension | 7 | 12.8% (24/306) |

*N* number

instability events (8.4%). In 13 studies, there were 5 cases of recurrent dislocations (0.9%) and 37 cases of recurrent subluxations (6.7%) out of 547 total shoulders. In 7 studies, there were 24 reported cases of apprehension out of 306 total shoulders (13.2%) (Table 3).

## Revisions, complications, arthropathy, and pain

The overall revision rate was available in 14 studies and 569 shoulders [5, 8, 14–17, 31, 32, 37, 38, 40, 41, 43, 44]. There were 29 total revisions resulting in a revision rate of 5.1%. In the same population, there were 12 cases of revision due to recurrent instability resulting in a rate of 2.1%. The complication rate was available in 13 studies and 618 shoulders [5, 8, 14, 16, 17, 19, 31, 32, 37, 38, 40, 41, 44]. There were a total of 68 complications resulting in a complication rate of 11.0%. Of these, there were 13 cases of nerve damage (2.1%), 13 cases of infection (2.1%), 10 cases of non-union or fibrous union (1.6%), 5 cases of painful hardware (0.8%), 5 screw related complications (0.8%), 4 cases of wound dehiscence (0.6%), 3 graft fractures (0.5%), 1 frozen shoulder (0.1%), and 1 hematoma (0.1%). Seven studies with 262 shoulders presented with 17 cases of new osteoarthritis (6.5%) [5, 8, 31, 37, 38, 40, 41]. Ten studies with 466 shoulders had 31 cases of residual pain (6.7%) [8, 14, 16, 17, 31, 37, 38, 40, 41, 44] (Table 4).

**Table 4** Revisions, complications, arthropathy, and pain

| Outcome | Studies | Result (*N*) |
|---|---|---|
| Total revisions | 14 | 5.1% (29/569) |
| Revisions due to recurrence | 14 | 2.1% (12/569) |
| Total complications | 13 | 11.0% (68/618) |
| Nerve damage | | 2.1% (13/618) |
| Infection | | 2.1% (13/618) |
| Non/fibrous union | | 1.6% (10/618) |
| Hardware failure | | 0.8% (5/618) |
| Screws (break/loose) | | 0.8% (5/618) |
| Wound dehiscence | | 0.6% (4/618) |
| Graft fracture | | 0.5% (3/618) |
| Frozen shoulder | | 0.1% (1/618) |
| Hematoma | | 0.1% (1/618) |
| New osteoarthritis | 7 | 6.5% (17/262) |
| Residual pain | 10 | 6.7% (31/466) |

*N* number

## Discussion

The most important finding of this study was that the open Latarjet procedure when performed as a revision procedure for failed prior anterior shoulder instability surgery resulted in excellent functional outcomes with low rates of complication, recurrence, and revision. In studies reporting on athletes, there was a high rate of return to sport. Furthermore, there was a low rate of new osteoarthritis reported. However, residual pain was common and is a concern in the clinical setting.

The recurrence rate found in this systematic review is similar to the 8.5% recurrence rate in a recent systematic review by Hurley et al. into the long-term outcomes of the Latarjet procedure in studies with greater than 10-year follow-up [25]. However, the systematic review by Hurley et al. did not differentiate between primary procedures and those done as a revision procedure. It is possible that the recurrence rate may be higher in the Latarjet done as a revision rather than a primary surgery. Yang et al. found that all cases of recurrence occurred in patients with the open Latarjet as a revision procedure for a previously failed shoulder stabilization surgery and no cases of recurrence in patients with a primary open Latarjet in a population of 52 patients [44]. Similarly, Shah et al. found that all cases of recurrence following the Latarjet occurred in patients with failed prior shoulder stabilization surgery [40]. Finally, Flinkkila and Sirniö found that as the number of previous arthroscopic Bankart operations increased, the all outcome measures decreased and the proportion of patients experiencing recurrences increased, indicating a worse result compared to those having a primary procedure [14].

The recurrence rate in this systematic review is lower than that found in a recent systematic review analyzing revision arthroscopic Bankart procedure after failed anterior shoulder stabilization procedure, which showed a mean incidence of recurrent instability of 12.7% in properly selected patients [1]. However, they found glenohumeral bone loss to be one of the primary causes of recurrence, which the Latarjet procedure addresses. Additionally, the stabilizing effect of the Latarjet has been shown to be durable over time with the majority of recurrent instability events occurring early in the first 2 years postoperatively, while the results of the arthroscopic Bankart repair seem to deteriorate over time [45].

An important finding from this study was the high rate of return to play, particularly given the risk in returning to sport after having at least one previous surgery before the open Latarjet. The return to competition at the same level as prior to the procedure was also very high with 87.6%. This percentage may be elevated due to a small sample with only five papers reporting on the level of competition the patient returned to. In a study including both primary and revision Latarjet procedures, Hurley et al. found the return to the same level of play to be closer to 70% [25]. Previous studies analyzing the primary Latarjet procedure found the return to play in collision athletes to range between 65 and 97% [9, 33, 39]. Furthermore, four previous studies have compared the rates of return to sport following the arthroscopic Bankart repair and open Latarjet procedure [3, 4, 26, 45]. None of these studies found a significant difference between the return to play when comparing the arthroscopic Bankart to the open Latarjet,however, when the rates between studies were pooled, the open Latarjet had a higher rate return to play of 83.5% compared to the arthroscopic Bankart's rate of 70.3%.

This review found high patient reported functional outcome scores with 90.4% of patients experiencing good to excellent outcomes and 94.3% being satisfied with the procedure. In a review of long-term outcomes of the Latarjet procedure, Hurley et al. reported similar findings with 86% experiencing good to excellent outcomes and 94.8% satisfaction [25]. Warth et al. found that the ability to return to sport was the greatest concern of patients undergoing anterior shoulder stabilization surgery, therefore, it is possible that the high level of satisfaction may be related to the high rate of return to play seen in the study [42].

There was a low rate of revisions with only 5.1% of patients undergoing a revision procedure. This is similar to the 3.7% found by Hurley et al. in a recent systematic review on the long-term outcomes of Latarjet procedure [25]. Recurrence accounted for 12 (41.3) of the total subsequent revisions reported in this study. Other causes of revision commonly include problems related to the hardware such as screws breaking, loosening, or penetrating into the joint [20]. Similar to recurrence, both Yang et al. and Shah

et al. found that all patients requiring a subsequent revision procedure had already had a previous failed shoulder stabilization surgery [40, 44].

This review found a complication rate of 11.0%, which is lower than the 30% reported complication rate found by a systematic review on complications of the Latarjet procedure by Griesser et al. [20]. Yang et al. found that all complications in their study occurred in patients with prior failed shoulder stabilization surgery [44]. In a study of 29 patients with prior shoulder stabilization procedures, Minkus et al. found a higher complication rate in those with multiple procedures than those with one (40% vs. 21%) [31]. In their study of 47 patients, Shah et al. remarked on a trend toward a higher prevalence of complications with multiple prior surgical procedures [40]. They found that all complications due to infection and three out of five cases of neurologic complication occurred in patients with prior failed shoulder stabilization surgery. However, in a larger study, Gartsman et al. found that there was not a significant association between prior surgery and risk or type of complications between patients with no and those with prior surgery [19].

There was a low rate of new instability arthropathy found in this review. However, this review contained many studies with short follow-up times. These studies may not provide a long enough follow-up time to the true incidence of new degenerative articular changes increasing over time, as Hurley et al. found almost a quarter of patients had progressive arthropathy after 10 years [25]. However, these findings indicate that a revision Latarjet may not be a significant greater increase in risk for progressive arthropathy compared with a primary bony procedure. There was residual pain found in 6.7% of patients despite the high rate of satisfaction. It is possible that several of these cases may be related to degenerative changes, as these outcomes were reported in several of the same studies with similar rates of new osteoarthritis and residual pain. However, pain is unlikely to be entirely due to degeneration. Hurley et al. found that almost a third of patients had residual pain, although less than 5% of these patients experienced daily pain, and thus the number of patients with residual patients will likely progress over time [25]. Additionally, Schmid et al. found that pain was likely to persist and compromise the subjective outcome if the recurrence associated was with chronic pain [41].

This study has several limitations and possible sources of bias. A potential bias was limiting the search criterion to only English articles, as a lot of research on this subject has been done in non-English speaking countries such as France. All included studies were low-level studies, all but one was retrospective, and none were controlled studies. It is possible that the number of different surgeons and the variety of techniques used may influence outcomes.

## Conclusion

This study is clinically relevant as it provides insight to the specific expected outcomes associated with the Latarjet procedure performed as a revision. This systematic review has shown that the Latarjet procedure as a revision procedure for failed prior shoulder instability surgery provides excellent functional outcomes, low rates of recurrence and complications, and a high rate of return to sport among athletes.

## Compliance with ethical standards

**Conflict of interest** All authors declare that they have no conflict of interest.

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**Ethical approval** This study did not require ethical approval as it is a systematic review.

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