Postoperative recovery comparisons of arthroscopic Bankart to open Latarjet for the treatment of anterior glenohumeral instability

Jarret M. Woodmass1,2 · Eric R. Wagner1,3 · Jennifer Smith1 · Kathryn M. Welp1,4 · Michelle J. Chang1,5 · Marc P. Morissette2 · Laurence D. Higgins6 · Jon J. P. Warner1

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Abstract

Background Recurrent anterior glenohumeral instability is a disabling pathology that can be successfully treated by arthroscopic Bankart repair or open Latarjet. However, there is a paucity of studies comparing the postoperative recovery. The purpose of this study is to evaluate the postoperative pain and functional recovery following arthroscopic Bankart versus open Latarjet.

Methods This is a retrospective analysis of a multicenter prospective outcomes registry database. Postoperative recovery outcomes of either a primary or revision arthroscopic Bankart and open Latarjet procedures were compared. A minimum of 1-year follow-up was required. Outcomes measures included pain visual analog scale (VAS), American Shoulder and Elbow Surgeons (ASES) function score, ASES index score, and single assessment numeric evaluation (SANE) score. Overall, 787 patients underwent primary arthroscopic Bankart, 36 underwent revision arthroscopic Bankart and 75 underwent an open Latarjet procedure.

Results When compared to primary arthroscopic Bankart, open Latarjet demonstrated significantly lower VAS scores at 6 weeks ($p = 0.03$), 3 months ($p = 0.01$), and 2 years ($p < 0.05$). Medium-term outcomes for ASES scores and SANE score, at 1 and 2 years showed no difference. Latarjet demonstrated significantly lower ($p < 0.05$) preoperative early postoperative VAS pain scores with no difference at 1 year or 2 years when compared to primary Bankart. There was no difference in ASES function or index between Bankart and Latarjet. Revision Bankart provided inferior outcomes for VAS, ASES function, and ASES index when compared to primary Bankart and Latarjet at 1 year and 2 years.

Conclusions Primary arthroscopic Bankart repair and open Latarjet provided nearly equivalent improvements in pain (VAS) and functional outcomes (ASES, SANE, VR-12) during the early recovery phase (2 years). This study supports the use of either procedure in the primary treatment of anterior glenohumeral instability. Revision arthroscopic Bankart repair demonstrated deteriorating outcomes at 1 and 2 years postoperatively.

Keywords Arthroscopic Bankart · Latarjet · Recovery curves

* Jon J. P. Warner
  jwarner@mgh.harvard.edu

Jarret M. Woodmass
jarretwoodmass@gmail.com

Eric R. Wagner
eric.erwagner@gmail.com

Jennifer Smith
smithjennifer23@gmail.com

Kathryn M. Welp
welpkm@gmail.com

Michelle J. Chang
mchang.jh@gmail.com

Marc P. Morissette
marc.p.morissette@gmail.com

Laurence D. Higgins
laurencedhiggins@gmail.com

1 Boston Shoulder Institute, Boston, MA, USA
2 Pan Am Clinic, University of Manitoba, Winnipeg, MB, Canada
3 Department of Orthopaedic Surgery, Emory University, Atlanta, GA, USA
4 Tufts University School of Medicine, Boston, MA, USA
5 Kansas City University of Medicine and Biosciences, Kansas City, MO, USA
6 King Edward Memorial Hospital, Hamilton, Bermuda
Introduction

Although approximately 1.7% of the population experiences anterior glenohumeral instability (AGHI)\[1\], the optimal treatment remains controversial. There are multiple factors that impact treatment outcomes, including age, gender, sports participation, glenoid, and humeral bone loss [2–4]. In those patients that undergo surgical stabilization, there remains a relatively high recurrence rate [5, 6].

Arthroscopic Bankart repair and open Latarjet are among the most common surgical options for addressing recurrent AGHI after a failure of conservative management. Arthroscopic Bankart repair is commonly performed in the primary setting for patients with minimal bone loss [7]. Significant improvements in pain and function have been reported after arthroscopic Bankart repair [8, 9]. Open Latarjet is often reserved for patients with measurable bone loss exceeding 13.5% [10] or as a salvage procedure in the revision setting [11, 12]. However, recent evidence has demonstrated that open Latarjet provides significantly lower rates of recurrent instability, apprehension, and operative revision when compared to arthroscopic Bankart repair at long-term follow-up [6, 13–15]. This has led some surgeons to prefer the Latarjet for all primary cases of glenohumeral instability [6].

Despite differing opinions on the optimal surgical stabilization technique for recurrent AGHI in both the primary and revision setting, there remains a paucity of clinical series comparing the process of recovery and the outcomes of these two procedures. In particular, the early postoperative recovery outcomes of arthroscopic Bankart repair and open Latarjet remain relatively unknown. The purpose of this study is to compare the process of early postoperative recovery for pain and function after arthroscopic Bankart repair, revision Bankart repair, and Latarjet. We hypothesized that there is no difference in postoperative pain or functional recovery following arthroscopic Bankart and open Latarjet.

Methods

Surgical outcomes system database

After approval from our institutional review board, we performed a retrospective analysis of a multicenter prospective outcomes registry database (Surgical Outcomes System (SOS) database; Arthrex Inc., Naples, FL). After consented for participation, patients receive seven surveys via email over the course of 2 years at select time intervals assessing patient-reported outcome measures regarding pain, range of motion, and functional scores. Operative details from each surgery are entered into the patient’s SOS record by the care team. Aside from a preoperative survey, patients received questionnaires at 2 weeks, 6 weeks, 3 months, 6 months, 1 year, and 2 years. Outcomes measured included patients’ American Shoulder and Elbow score (ASES), VR-12 physical score, SANE score (also known as subjective shoulder value), and visual analog scale (VAS) for pain, on a scale of 0 to 10. Patients were included who underwent surgery for recurrent anterior glenohumeral instability. Patients were excluded if they did not complete a preoperative baseline surgery questionnaire or did not have at least 6 months of follow-up in the database.

Patient demographics

A total of 898 patients were included in the study. There were 75 patients who underwent an open Latarjet procedure (primary or revision), 787 patients who had a primary arthroscopic Bankart surgery, and 36 patients with a revision arthroscopic Bankart procedure. There were no significant differences between the demographics of the three cohorts for gender, ethnicity, race, smoking status, diabetes diagnosis, insurance coverage, age, or body mass index (BMI). The demographic information is summarized in Table 1.

Statistical analysis

Descriptive statistics were utilized for overall outcomes and relevant comparisons between the open Latarjet, primary arthroscopic Bankart, and revision arthroscopic Bankart procedures. Dichotomous variables were compared using Fisher’s exact test. A two-way mixed-model ANOVA was used to test for differences in PROMs, with surgical group as the between-subject factor and time as the within-subject factor. A $p$ value < 0.05 was considered statistically significant. We performed a power analysis, using a minimum clinically important difference (MCID) of 17 points in the ASES score [16] and based on a prior study with a mean of approximately 86 points (SD 20) [17]; to find a 17 point difference in ASES scores, using a power of 0.8, alpha of 0.05, and allocation ratio of 1, the number needed per group is 23.

Results

Recovery curves for VAS (Fig. 1), ASES function (Fig. 2a), ASES index (Fig. 2b), SANE (Fig. 3a), and VR-12 physical (Fig. 3b) demonstrate the scores for open Latarjet, primary arthroscopic Bankart, and revision arthroscopic Bankart.
Table 1 Study population demographics

|                          | Latarjet (n = 75) | Primary Bankart (n = 787) | Revision Bankart (n = 36) |
|--------------------------|------------------|--------------------------|---------------------------|
| **Gender**               |                  |                          |                           |
| Male                     | 78.7% (59)       | 65.8% (518)              | 66.7% (24)                |
| Female                   | 16.0% (12)       | 30.5% (240)              | 27.8% (10)                |
| Unlisted                 | 5.3% (4)         | 3.7% (29)                | 5.6% (2)                  |
| **Ethnicity**            |                  |                          |                           |
| Non-Hispanic             | 80.0% (60)       | 65.7% (517)              | 55.6% (20)                |
| Hispanic                 | 4.0% (3)         | 2.9% (23)                | 0.0% (0)                  |
| Unlisted                 | 16.0% (12)       | 31.4% (247)              | 44.4% (16)                |
| **Race**                 |                  |                          |                           |
| White                    | 60.0% (45)       | 52.7% (415)              | 2.8% (1)                  |
| Black                    | 9.3% (7)         | 4.4% (35)                | 22.2% (8)                 |
| Asian                    | 4.0% (3)         | 1.1% (9)                 | 2.8% (1)                  |
| Hawaiian                 | 1.3% (1)         | 0.1% (1)                 | 0.0% (0)                  |
| Unlisted                 | 25.3% (19)       | 41.6% (327)              | 44.4% (16)                |
| **Tobacco Use**          |                  |                          |                           |
| Non-smoker               | 88.0% (66)       | 71.7% (564)              | 69.4% (25)                |
| Smoker                   | 6.7% (5)         | 8.3% (65)                | 2.8% (1)                  |
| Unlisted                 | 5.3% (4)         | 20.1% (158)              | 27.8% (10)                |
| **Diabetes**             |                  |                          |                           |
| Non-diabetic             | 89.3% (67)       | 73.8% (581)              | 69.4% (25)                |
| Diabetic                 | 4.0% (3)         | 4.1% (32)                | 2.8% (1)                  |
| Unlisted                 | 6.7% (5)         | 22.1% (174)              | 27.8% (10)                |
| **Coverage**             |                  |                          |                           |
| Non-workers’ Compensation| 94.7% (71)       | 71.7% (564)              | 61.1% (22)                |
| Workers’ Compensation    | 0.0% (0)         | 7.9% (62)                | 13.9% (5)                 |
| Unlisted                 | 5.3% (4)         | 20.5% (161)              | 25.0% (9)                 |
| Age                      | 32.8 ± 11.5      | 41.3 ± 16.8              | 38.6 ± 14.8               |
| BMI                      | 25.6 ± 4.0       | 27.2 ± 5.7               | 28.1 ± 5.1                |

Fig. 1 Recovery curves for VAS pain scores
VAS pain scores

The Latarjet procedure demonstrated significantly lower pain scores \((p < 0.05)\) preoperatively and at 6 weeks, 3 months, and 6 months compared to primary arthroscopic Bankart repair (Table 2; Fig. 1). When compared to revision arthroscopic Bankart procedures, open Latarjet provided significantly lower pain scores preoperatively and at 2 weeks, 6 weeks, 3 months, and 2 years \((p < 0.05)\). When compared to revision arthroscopic Bankart procedures, primary arthroscopic Bankart provided significantly lower pain scores at 6 weeks, 3 months, and 2 years \((p < 0.05)\) (Table 2).

ASES, SANE, and VR-12 scores

Primary arthroscopic Bankart repair and open Latarjet had statistically significant \((p < 0.01)\) preoperative to postoperative improvements in ASES function, ASES index, and SANE scores at 6 months, 1 year, and 2 years (Table 3). Latarjet procedure when compared to a primary arthroscopic Bankart, showed no difference for measures of ASES function, ASES index, or SANE scores at 6 months, 1 year, and 2 years (Table 3). Compared to a revision arthroscopic Bankart, Latarjet and Primary Bankart outcomes were significantly higher \((p < 0.05)\) at 2 years for ASES function, ASES index, and SANE scores.

Discussion

The optimal management of patients with recurrent AGHI remains controversial. While non-operative management is successful in the majority of patients following an initial dislocation, patients with recurrent instability experience considerable disability and lost time from athletics or work. Arthroscopic Bankart repair has traditionally been favored over Latarjet for its minimally invasive nature and ability to restore normal anatomy. Additionally, arthroscopic Bankart...
repair has been shown to provide predictable pain relief and improvements in functional outcomes [8, 9, 18]. However, there has been growing concern over the long-term durability of arthroscopic Bankart repair with a high rate of late recurrence after 6 years postoperatively [6, 19]. Conversely, the Latarjet procedure is often reserved for glenohumeral instability in the presence of bone loss demonstrating predictable improvements in function with low rates of late recurrence [2, 20, 21].

In the current study, we evaluated 898 patients of which 75 underwent Latarjet, 787 underwent primary arthroscopic Bankart repair and 36 patients had revision arthroscopic Bankart repair and compared the early recovery curves for pain and function. Primary arthroscopic Bankart repair

### Table 2 Comparisons of VAS between surgical groups

|                      | Pre-op | 2 weeks | 6 weeks | 3 months | 6 months | 1 year | 2 years |
|----------------------|--------|---------|---------|----------|----------|--------|---------|
| Latarjet             | 1.90 ± 2.56 | 2.46 ± 1.64 | 1.57 ± 1.29<sup>2</sup> | 0.86 ± 0.91<sup>2</sup> | 0.74 ± 0.89<sup>2</sup> | 0.78 ± 1.18<sup>2</sup> | 0.71 ± 1.10<sup>2</sup> |
| Primary Bankart      | 4.21 ± 2.44<sup>*</sup> | 3.18 ± 2.06<sup>5</sup> | 2.39 ± 1.96<sup>5,2</sup> | 1.89 ± 1.85<sup>5,2</sup> | 1.53 ± 1.80<sup>5,2</sup> | 1.19 ± 1.68<sup>5,2</sup> | 1.22 ± 1.84<sup>5,2</sup> |
| Revision Bankart     | 4.15 ± 3.39<sup>*</sup> | 4.76 ± 2.66<sup>*</sup> | 3.93 ± 2.68<sup>2</sup><sup>##</sup> | 3.46 ± 3.02<sup>2</sup><sup>##</sup> | 1.51 ± 2.36 | 1.66 ± 1.73 | 2.87 ± 3.11<sup>2</sup><sup>##</sup> |

Data are presented as mean ± standard deviation. Significance set at <i>p</i> < 0.05. *Different from Latarjet at same time point. <sup>5</sup>Different from Primary Bankart at same time point. <sup>2</sup>Different from pre-op of same surgical group. <sup>5</sup>Different from 2wk of same surgical group. <sup>2</sup>Different from 6wk of same surgical group. <sup>##</sup>Different from 3 mth of same surgical group. <sup>%</sup>Different from 6 mth of same surgical group.
and Latarjet demonstrated very similar recovery curves throughout the first 2 years with both procedures resulting in improvements in pain and function when compared to pre-operative measurements (Table 2; Figs. 1, 2, 3). When these procedures were directly compared, the VAS pain scores for Latarjet were significantly lower than those observed for arthroscopic Bankart repair both preoperatively and throughout the early recovery phase [3, 6, 6] with no difference at 1 year and 2 years (Table 2). The postoperative pain scores following Latarjet remained low throughout the study duration peaking at 2.8 points at 2 weeks postoperatively and ultimately decreasing to a mean of 0.9 points at final follow-up [2]. Furthermore, patient-reported outcomes including ASES function, ASES index, and SANE showed no difference between the two procedures at any time point. These findings are supported by a recent systematic review and meta-analysis comparing Latarjet to Bankart repair that concluded that the Latarjet procedure is a viable and possibly superior alternative to the Bankart repair, offering greater stability with no significant increase in complication rate [22].

The utilization of the Latarjet procedure is very common in Europe, while the United States has been slow to adopt it. Currently, treatment with arthroscopic Bankart accounts for 87% for cases of AGHI versus 3% Latarjet procedures according to a large United States national database [23]. However, this same study demonstrated the Latarjet has increased by a rate of 15% per year from 2007 to 2015 [23]. This relatively slow adoption may be related to concern for early postoperative complications, reported as high as 25%, including up to a 10% rate of neurologic injury [17]. Intra-operative neuromonitoring has since highlighted at risk parts of the Latarjet procedure [24] and a nerve stretch reduction protocol can reduce the rate of detectable nerve injuries by over 65% [25]. Furthermore, nearly all nerve injuries are neuropaxias with complete recovery [25]. More recently, Gartsman et al. [26] reported the rate of early complications following 416 Latarjet procedures to be only 5% with a neurologic injury rate of 3.1%, the majority of which were transient. Thus, when recurrent instability is considered a complication, the rate of complications following Bankart repair vastly exceeds that of Latarjet at long-term follow-up. Although we were not able to evaluate and compare the rate of complications following Latarjet and arthroscopic Bankart repair in this study, it is known that patients who sustain a complication following Latarjet have significantly worse functional outcome. Shah et al. [17] demonstrated that the ASES score after a Latarjet with a complication was 69.9 versus 91.8 ($p < 0.001$). In the current study, the mean ASES score at 2 years following Latarjet was 89.2 points, similar to primary Bankart measuring 85.8 points, reflecting that complications are relatively rare.

Pain and functional outcome measures following revision arthroscopic Bankart repair were universally worse when compared to Latarjet and primary arthroscopic Bankart at nearly all time-points postoperatively (Tables 2, 3; Figs. 1, 2, 3). In the revision setting, a clear deterioration in both pain and function was identified in our study as early as 1 year postoperatively. While revision arthroscopic Bankart repair has shown the potential to provide satisfactory outcomes in carefully selected patients [27], the rate of recurrent instability exceeds 20% at mean of 36 months [27]. The increased pain and decline in functional outcome observed in this study may reflect the onset of complications.

| Latarjet versus Primary Bankart versus Revision Bankart | Pre-op | 6 months | 1 year | 2 years |
|--------------------------------------------------------|--------|----------|--------|--------|
| **ASES function**                                       |        |          |        |        |
| Latarjet                                               | 20.19 ± 5.44 | 24.25 ± 4.61$ | 26.19 ± 3.21$ | 27.31 ± 3.34$ |
| Primary Bankart                                        | 16.42 ± 6.68* | 23.76 ± 5.42 | 26.05 ± 4.68$ | 26.28 ± 4.97$ |
| Revision Bankart                                       | 18.60 ± 9.31 | 23.70 ± 6.36 | 23.80 ± 7.25 | 21.00 ± 8.47## |
| **ASES index**                                         |        |          |        |        |
| Latarjet                                               | 74.13 ± 19.15 | 86.79 ± 10.99$ | 89.56 ± 10.25$ | 92.25 ± 10.16$ |
| Primary Bankart                                        | 56.16 ± 19.61* | 82.40 ± 15.20$ | 87.74 ± 14.34$ | 88.06 ± 15.61$ |
| Revision Bankart                                       | 61.50 ± 30.05 | 82.19 ± 20.44 | 79.68 ± 20.69 | 69.08 ± 28.90## |
| **SANE**                                               |        |          |        |        |
| Latarjet                                               | 45.09 ± 23.60 | 77.99 ± 15.61$ | 86.24 ± 22.86$ | 83.74 ± 14.52$ |
| Primary Bankart                                        | 41.34 ± 21.38 | 73.80 ± 19.49$ | 81.17 ± 19.85$ | 80.31 ± 23.30$ |
| Revision Bankart                                       | 41.80 ± 26.01 | 76.80 ± 16.06$ | 78.70 ± 20.89$ | 62.50 ± 36.29## |
| **VR-12 physical**                                     |        |          |        |        |
| Latarjet                                               | 45.84 ± 7.42 | 49.86 ± 5.19 | 52.89 ± 4.15 | 53.79 ± 5.42 |
| Primary Bankart                                        | 39.28 ± 8.82 | 46.79 ± 8.32 | 49.39 ± 7.88 | 50.37 ± 7.55 |
| Revision Bankart                                       | 40.73 ± 10.32 | 46.52 ± 11.98 | 47.24 ± 9.89 | 47.29 ± 9.93 |

Data are presented as mean ± standard deviation. Significance set at $p < 0.05$. *Different from Latarjet at same time point. #Different from Primary Bankart at same time point. $Different from pre-op of same surgical group. †Main effect of group as compared to Latarjet. *Main effect of time, where: 6 mth, 1 year, and 2 year > Pre-op; 1 year and 2 year > 6 mth.
of recurrent instability when patients are cleared to return to sporting activities. Although many patients return to sport after revision arthroscopic Bankart, 90% describe a limitation in their shoulder during participation [28]. Buckup et al. [28] reported a mean Subjective Patient Outcome for Return to Sports (SPORTS) score of 5.2 out of 10, and therefore, recommended advising patients that although they can return to activities, they must expect persistent deficits and limitations of the shoulder with a low probably of return to activities with greater demand on the shoulder [28]. In the current study, it was not possible to determine if a Latarjet procedure was performed as a primary intervention versus a revision intervention following a failed Bankart procedure. Furthermore, patients who failed a Latarjet and required a revision stabilization procedure such as an Eden Hybinette or tibial bone block were not captured. Thus, the direct comparison of revision Bankart to the Latarjet population in this study has inherent bias and should be interpreted with caution. However, it is evident that revision Bankart patients show a clear deterioration in pain and function at 1 year and 2 years. The degree of glenoid bone loss, Hill–Sachs size, age, gender, laxity, and other predictors of recurrent instability should be carefully assessed in the revision setting to determine if a bone block procedure will more reliably restore stability and function to the shoulder.

The following limitations should be considered when interpreting the results reported in this study. First, although this is one of the largest individual series evaluating the outcomes of arthroscopic Bankart repair to Latarjet, this study remains limited by its short-term follow-up. Second, there is a large discrepancy in the number of patients who underwent Bankart versus Latarjet procedure despite being treated for a similar pathology (i.e., recurrent glenohumeral instability). This suggests that a selection bias exists when surgeons are determining which procedure to perform. Third, the SOS database enables construction of patient-reported outcome recovery curves; however, these PROMS are not linked to intra-operative or postoperative complications, recurrence of instability, reoperations, surgical technique, or patient range of motion. We were also unable to evaluate radiographic parameters including osseous glenoid or humeral defects. Finally, as is the case for all databased studies, the outcomes are dependent on the accuracy of the coding of each surgery performed.

Despite these limitations, in this comparative study we are able to illustrate the postoperative pain and functional recovery curves for arthroscopic primary and revision Bankart repair and open Latarjet. This study demonstrates early outcomes for primary arthroscopic Bankart and Latarjet are nearly equivalent. Furthermore, this is the first study to demonstrate the significantly worse outcome that results following revision Bankart repair.

Conclusions

Primary arthroscopic Bankart repair and open Latarjet provide nearly equivalent improvements in pain (VAS) and functional outcomes (ASES, SANE, VR-12) during the postoperative recovery phase (2 years). This study supports the use of either procedure in the primary treatment of anterior glenohumeral instability. In the revision setting, arthroscopic Bankart repair demonstrated deteriorating outcomes at 1 and 2 years postoperatively.

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Declarations

Conflict of interest Dr Warner receives royalties from Stryker. Dr. Wagner is a consultant for Stryker, Acumed, Biomet, and Osteoremedies. No other authors have anything to disclose. None are relevant to this manuscript.

Ethical approval Each author certifies that his or her institution approved the human protocol for this investigation and that all investigations were conducted in conformity with ethical principles of research. Approved with IRB Protocol # 2011P002663.

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