Comparison of 30-Day Morbidity and Mortality After Arthroscopic Bankart, Open Bankart, and Latarjet-Bristow Procedures

A Review of 2864 Cases

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Background: Surgical intervention for anterior shoulder instability is commonly performed and is highly successful in reducing instances of recurrent instability.

Purpose: To determine and compare the incidence of 30-day complications and patient and surgical risk factors for complications for arthroscopic Bankart, open Bankart, and Latarjet-Bristow procedures.

Study Design: Cohort study; Level of evidence, 3.

Methods: All arthroscopic Bankart, open Bankart, and Latarjet-Bristow procedures from 2005 to 2014 from the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) prospective database were analyzed. Baseline patient variables were assessed, including the Charlson Comorbidity Index (CCI). Outcomes measures included length of operation, length of hospital stay, need for hospital admission, 30-day readmission, and 30-day return to the operating room. Binary logistic regression was performed for the presence of any complications after all 3 procedures.

Results: There were 2864 surgical procedures (410 open Bankart, 163 Latarjet-Bristow, and 2291 arthroscopic Bankart) included. There was no significant difference with regard to age ($P = .11$), body mass index ($P = .17$), American Society of Anesthesiologists class ($P = .423$), or CCI ($P = .479$) for each group. The Latarjet-Bristow procedure had the highest overall complication rate (5.5%) compared with open (1.0%) and arthroscopic (0.6%) Bankart repairs. The Latarjet-Bristow procedure had significantly longer mean operative times ($P < .001$) in addition to the highest 30-day return rate to the operating room (4.3%; 95% confidence interval, 1.2%-7.4%). Smoking status was an independent predictor of a postoperative complication ($P = .05$; odds ratio, 8.0) after Latarjet-Bristow.

Conclusion: Surgical intervention for anterior shoulder instability has a low rate of complication (arthroscopic Bankart, 0.6%; open Bankart, 1.0%; Latarjet-Bristow, 5.5%) in the early postoperative period, with the most common being surgical site infection, deep vein thrombosis, and return to the operating room.

Keywords: shoulder instability; Bankart repair; Latarjet-Bristow repair; National Surgical Quality Improvement Program; complication

Shoulder instability is a common problem in the United States.[3,5,9,28,30] If operative management is decided, there are numerous ways to address instability caused by subluxation events. The most commonly performed procedures are Bankart repair, both arthroscopic and open, and the Latarjet-Bristow procedure. Which procedure is performed is based on a number of factors, including injury type, degree of bone loss, and surgeon comfort level.[9,12] Shoulder instability surgery is generally considered to be safe and is performed predominantly on an outpatient basis in the United States.[14,25] Although the literature addresses graft failure, nonunion, recurrent subluxation/dislocation, and nerve injury,[14,25,27,29,32] few large prospective studies have defined the rate of complications, such as deep vein thrombosis (DVT), pulmonary embolus (PE), sepsis, need for admission, readmission, return to the operating room, and

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mortality, in the early preoperative period. Studies addressing perioperative complications have predominantly been single-center studies addressing graft misplacement, graft fracture, anchor failure, nerve injury, and infection, with limited information on patient risk factors and less frequent complications such as DVT and sepsis.[§]

Knowledge of Bankart and Latarjet-Bristow perioperative complication rates is important to adequately allow surgeons to provide an accurate preoperative description of the risks and benefits of surgical intervention, to properly set patient expectations, and to identify patient risk factors, which may place them at increased rate for adverse outcomes. The aim of this study was to determine and compare the incidence of 30-day complications after arthroscopic Bankart, open Bankart, and Latarjet-Bristow repairs for anterior shoulder instability using the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database and to identify patient and surgical risk factors for complications after these procedures. The NSQIP database has recently been applied to study the complications of a number of orthopaedic procedures,[||] but it has not been used to analyze and compare the rates of Bankart and Latarjet-Bristow complications.

METHODS

Source Data

The ACS NSQIP database utilized from January 2005 to December 2014 represents a high-quality, prospectively collected surgical database encompassing nearly 750 medical centers.[7] To adhere to the highest levels of data quality, hospitals are excluded from ACS NSQIP if their interobserver disagreement rate between clinical reviewers is greater than 5% or if their 30-day follow-up rate is less than 80%. This database provides a highly accurate source of 30-day postoperative complications and has been validated and used to a describe a large number of orthopaedic procedures to date.[||]

Data Collection

To compare Bankart and Latarjet-Bristow repairs, all cases from January 2005 to December 2014 with the following Current Procedural Terminology (CPT) codes were included: 23455 ("capsulorrhaphy, anterior, with labral repair"), 23462 ("capsulorrhaphy, anterior, any type; with coracoid process transfer"), and 29806 ("arthroscopy, shoulder, surgical; capsulorrhaphy"). With regard to baseline patient characteristics, a number of variables were collected, including age, sex, race, body mass index (BMI), and American Society of Anesthesiologists (ASA) class ranging from 1 (healthy patient) to 4 (potentially life-threatening medical disease). To compare baseline medical comorbidity among groups, preoperative Charlson Comorbidity Index (CCI) scores were also calculated for each patient.[6]

With regard to outcomes, several variables were collected, including length of operation, length of hospital stay, admission to the hospital after surgery, return to the operating room within 30 days, and readmission to the hospital within 30 days. A large number of 30-day complications were recorded in the NSQIP database, including postoperative infection (all instances of superficial dehiscence, cellulitis, and deep space infection), pneumonia, need for reintubation, DVT, PE, urinary tract infection, acute kidney injury (AKI), coma, stroke, myocardial infarction, and sepsis. There were no instances of reintubation, coma, stroke, or myocardial infarction, and as a result, these variables were not included in the data analysis. Overall complication rates were calculated for each procedure.

Finally, binary logistic regression was performed for the presence of any complication after arthroscopic Bankart, open Bankart, and the Latarjet-Bristow procedures. All baseline demographics and comorbidities were included as covariates in the model except for those comorbidities that were not present in the sample of patients undergoing these procedures. Variables included in the model were age, sex, race, smoking status, type of anesthesia used, presence of dyspnea at baseline, ASA class, BMI, history of diabetes, chronic obstructive pulmonary disease, hypertension, and having more than 2 alcoholic drinks in the 2 weeks prior to admission.

Statistical Analysis

All quantitative variables such as BMI, age, and operative duration were compared among the 3 different methods of shoulder stabilization using analysis of variance (ANOVA) along with Tukey post hoc testing, while categorical variables such as ASA class were compared among groups using chi-square test. We calculated 95% confidence intervals (CIs) for the proportion of patients requiring initial admission, experiencing any complication within 30 days, and being readmitted or returning to the operating room within 30 days. Binary logistic regression was performed, and the resulting odds ratios and 95% CIs were calculated for all independent predictors of a perioperative complication. Results were considered statistically significant in the absence of overlapping 95% CIs or with a P value lower than the specified cutoff of .05 (SPSS Statistics V21.0, IBM Corporation).

[§]References 1, 13, 14, 18, 25, 27, 29, 31, 32, 37.
[||]References 4, 8, 15, 16, 23, 24, 35, 36, 38.

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TABLE 1
Baseline Demographics and Medical Comorbidities for Patients Undergoing an Arthroscopic Bankart, Open Bankart, and Latarjet-Bristow Procedures[a]

	Arthroscopic Bankart	Open Bankart	Latarjet-Bristow	*P* Value
Sex				
Male	1696 (74)	331 (81)	134 (82)	
Female	595 (26)	79 (19)	29 (18)	
Age, y	31.8 ± 12.1	31.9 ± 12.7	29.8 ± 8.8	.11
BMI, kg/m^2	26.9 ± 6.5	26.0 ± 5.8	27.2 ± 6.0	.17
ASA class				.42
1	1079 (47)	191(47)	63 (39)	
2	1093 (48)	190 (46)	91 (56)	
3	112 (5)	27 (7)	9 (5)	
4	2 (0.1)	2 (0.5)	0 (0)	
CCI	0.04 ± 0.2	0.04 ± 0.2	0.02 ± 0.1	.48

[a]Data are shown as n (%) or mean ± standard deviation. ASA, American Society of Anesthesiologists; BMI, body mass index; CCI, Charlson Comorbidity Index.

RESULTS

A total of 2864 surgical procedures (410 open Bankart repairs, 163 Latarjet-Bristow procedures, and 2291 arthroscopic Bankart repairs) were included. As shown in Table 1, for open Bankart, Latarjet-Bristow, and arthroscopic Bankart, there was no significant difference with regard to age ($P = .11$), BMI ($P = .17$), ASA class ($P = .423$), or CCI ($P = .479$).

The average operative time for Latarjet-Bristow procedures (131.5 ± 49.2 minutes) was significantly longer than for both open (91.4 ± 46.6 minutes) and arthroscopic Bankart (81.6 ± 43.8 minutes), $P < .001$. A significantly greater percentage of patients undergoing a Latarjet-Bristow required inpatient admission (33.7%; 95% CI, 26.4%-41.0%) compared with open Bankart (21.9%; 95% CI, 17.9%-26.0%), which had a significantly greater admission rate than arthroscopic Bankart repairs (7.6%; 95% CI, 6.5%-8.6%).

Overall, the Latarjet-Bristow procedure had the highest complication rate, with 5.5% of cases experiencing a complication (95% CI, 2.0%-9.0%). More specifically, these included 4 instances of surgical site infection (2.5%), 3 instances of DVT (1.8%), and 2 instances of sepsis (1.2%) (Table 2). This 5.5% complication rate was significantly higher than the complication rate for both open (1.0%; 95% CI, 0.02%-1.9%) and arthroscopic (0.6%; 95% CI, 0.03%-0.9%) Bankart repairs. For the open Bankart repair, there was 1 instance of surgical site infection (0.2%), 1 instance of pneumonia (0.2%), 1 instance of AKI (0.2%), and 1 episode of sepsis (0.2%), whereas for arthroscopic Bankart repair, there were 6 surgical site infections (0.3%), 3 urinary tract infections (0.1%), 2 DVTs (0.1%), 1 episode of pneumonia (0.04%), 1 PE (0.04%), and 1 AKI (0.04%).

Patients undergoing a Latarjet-Bristow procedure had a 30-day return rate to the operating room of 4.3% (95% CI, 1.2%-7.4%), which was significantly greater than either open (0.2%; 95% CI, 0%-0.7%) or arthroscopic (0.2%; 95% CI, 0%-0.9%) Bankart repairs. Similarly, 30-day readmission rates were highest, although not significantly so, for Latarjet-Bristow procedures (3.1%; 95% CI, 0.4%-5.7%) compared with open (0.2%; 95% CI, 0%-0.7%) and arthroscopic (0.2%; 95% CI, 0%-1.0%) Bankart repairs.

Binary regression analysis found no independent predictors of a complication after either arthroscopic or open Bankart repairs. For the Latarjet-Bristow procedure, smoking status was an independent predictor of a perioperative complication ($P = .05$, odds ratio = 8.0).

DISCUSSION

This study used the prospectively collected NSQIP database to determine the incidence of 30-day complications after arthroscopic Bankart, open Bankart, and Latarjet-Bristow procedures. We found that the overall rate of complication was 0.6% and 1.0% for arthroscopic and open Bankart repairs, respectively, and 5.5% for Latarjet-Bristow repair. Complications for the Latarjet-Bristow procedure were found to be significantly higher than those of Bankart repair. Return to the operating room was also significantly higher for the Latarjet-Bristow procedure. Thirty-day readmission rates were higher for Latarjet-Bristow as well, although this was not statistically significant. Binary regression analysis found that smoking was an independent risk factor for complication after a Latarjet-Bristow procedure.

Surgical intervention for anterior instability is generally very successful at returning athletes to play without surgical complication. A majority of studies looking at complication rates have examined the incidence of long-term

TABLE 2
Summary of Perioperative Outcomes After the Arthroscopic Bankart, Open Bankart, and Latarjet-Bristow Procedures[a]

	Arthroscopic Bankart	Open Bankart	Latarjet-Bristow	*P* Value, ANOVA
Complication rate, % (95% CI)	0.6 (0.03-0.9)	1.0 (0.02-1.9)	5.5 (2.0-9.0)	<.05
Requiring admission, % (95% CI)	7.6 (6.5-8.6)	21.9 (17.9-26.0)	33.7 (26.4-41.0)	<.05
Operative time, min, mean ± SD	81.6 ± 43.8	91.4 ± 46.6	131.5 ± 49.2	<.001
30-day return to OR, % (95% CI)	0.2 (0-0.9)	0.2 (0-0.7)	4.3 (1.2-7.4)	<.05
30-day readmission, % (95% CI)	0.2 (0-1.0)	0.2 (0-0.7)	3.1 (0.4-5.7)	>.05

[a]ANOVA, analysis of variance; OR, operating room.

recurrent instability or need for revision surgery.[¶] Waterman et al[37] reported a 4.5% failure rate for arthroscopic Bankart repair and a 7.7% failure rate for open surgery. The 2-year failure rate for arthroscopic Bankart repair is reported to be 13%, with authors reporting rates of 4% to 19%.[1,25] Griesser et al[13] performed a systematic review and found a 7% incidence of recurrent dislocation and need for reoperation after Latarjet-Bristow repair with a mean follow-up of 6.8 years.

Other studies have focused primarily on the intraoperative complications of stabilization surgery. It is believed that open Bankart repair has a higher risk of complication than arthroscopic. This has been demonstrated by an increase in the incidence of arthroscopic Bankart repair in the past decade. From 2003 to 2005, 71.2% of Bankart repairs were arthroscopic compared with 87.7% from 2006 to 2008.[29] Infection has been well studied as well, with the rate of infection after arthroscopic Bankart being reported to be 0.22% and that after open repair reported to be 0.33%.[21,26,29] Our study found a 0.3% and 0.2% rate of infection for arthroscopic and open Bankart repairs, respectively, similar to reported rates.

The Latarjet-Bristow procedure for anterior instability has been found to have a higher intraoperative complication rate than the Bankart procedure.[2,13,17,20] With regard to short-term complication after Latarjet-Bristow repair, Shah et al[34] reported superficial infection in 3 of 48 (6%) patients. All the cases of infection resolved with a course of oral antibiotics. Our study found a rate of 2.5% comparatively, which is likely due to the larger sample size (163 procedures), which may allow for a more representative patient population.

Martin et al[23] performed a database study of shoulder arthroscopy complications in the early postoperative period. Their study examined 9410 cases of elective shoulder arthroscopy and found an overall complication rate of 0.99%, along with individual rates for the following complications: superficial infection (0.16%), deep infection (0.01%), DVT or thrombophlebitis (0.09%), peripheral nerve injury (0.01%), and PE (0.06%). They also reported the readmission rate after arthroscopy to be 1.02%, with a 0.31% return to the operating room.[23] Martin et al examined all arthroscopic shoulder CPT codes, while our study solely examined arthroscopic Bankart repair. Comparatively, our study found that arthroscopic Bankart repair, while having a lower overall complication rate (0.3%), had slightly higher rates of several complications compared with routine shoulder arthroscopy (surgical site infections, 0.3%; DVT, 0.1%).

Open surgery in general is associated with a higher complication rate than an arthroscopic one; however, the difference in complication rate between open Bankart repair (1.0%) compared with Latarjet-Bristow repair (5.5%) was statistically significant, indicating an increased risk of 30-day complication after Latarjet-Bristow procedure. Additionally, the identification of smoking as a significant predictor of complication following Latarjet-Bristow needs to be considered. Indeed, in light of these results and other studies showing that smokers are at risk for complications related to wound healing, smoking status should be discussed prior to operation, with appropriate cessation counseling performed.[8]

We found that a significant complication after shoulder instability surgery was DVT, which has not been well published. A retrospective review of 15,000 shoulder arthroscopy cases found a 0.15% rate of DVT; all patients who developed DVT underwent surgery in the beach-chair position.[33] While DVT after arthroscopic surgery is uncommon, it may be slightly more prevalent after open shoulder surgery. It is believed that the rate of DVT after shoulder arthroplasty is 0.05%.[22] However, the incidence of computed tomography scan–confirmed PE after proximal humerus fixation has been reported to be as high as 5.1%.[19] Various reported rates for DVT after shoulder surgery have led to confusion regarding appropriate postoperative thromboprophylaxis. The ninth edition of the American College of Chest Physicians guidelines for thromboprophylaxis did not make any recommendations with regard to prophylaxis in individuals with no thromboembolic history undergoing shoulder surgery, and only commented on "major procedures" (knee and hip arthroplasty and hip fracture surgery).[10] While uncommon, there are many risk factors that have been shown to increase the rate of DVT, including obesity, malignancy, smoking, history of venous thromboembolism, and hormone therapy.[11] Our study also found a low rate of DVT, albeit with a higher rate after Latarjet-Bristow repair (1.8%).

With regard to readmission, our study found a higher rate for Latarjet-Bristow (3.1%), compared with open and arthroscopic Bankart repairs (0.2% each). Admission after surgery in general was significantly higher after Latarjet-Bristow (33.7%; 95% CI, 26.4%-41.0%) compared with the open Bankart (21.9%; 95% CI, 17.9%-26.0%), which had a significantly greater admission rate than arthroscopic repairs (7.6%; 95% CI, 6.5%-8.6%). Return to the operating room was also significantly higher after Latarjet-Bristow repair at 4.3% (95% CI, 1.2%-7.4%) compared with 0.2% for both open and arthroscopic Bankart repairs.

This study has several limitations; most are related to the inherent limitations of the NSQIP database itself. The data are limited by the time frame of data collection, the 30-day immediate perioperative period, and they do not examine long-term outcomes. Complications such as DVT, PE, infection, recurrent dislocation, stiffness, nerve injury, or need for reoperation may have occurred outside of this 30-day period. Despite the large number of institutions captured by the NSQIP database, procedures performed in independent surgery centers are not included in this study, so our results may not be fully representative of all shoulder stabilization procedures. Also, this database does not list the reasons for return to the operating room, which limits our analysis. It must also be noted that the experience level of the surgeon is not documented in NSQIP. Therefore, it is possible that inexperience may have played a role in the larger number of complications associated with the Latarjet-Bristow procedure. Furthermore, patients undergoing the Latarjet-Bristow procedure are generally

[¶]References 1, 13, 14, 18, 25, 27, 30, 31, 37.

more likely to have failed previous therapy or have significant bone loss, making the indications for the procedure much different. Additionally, orthopaedic-specific data—such as number of anchors used, type of anchors used, size and number of screws used for Latarjet-Bristow fixation, use of DVT prophylaxis, postoperative therapy protocols, and outcome-specific measures specific to instability procedures—are not made available as part of the database. Along these lines, the CPT code used here for arthroscopic Bankart repair may be used with all types of shoulder instability (not just anterior), as we did not separate instability out by direction. In addition, we were unable to determine surgeon experience or hospital volume for a specific procedure. Despite this, the NSQIP did allow us to determine the incidence of uncommon but serious complications associated with anterior instability surgery, specifically with regard to the Bankart and Latarjet-Bristow procedures in the immediate perioperative period, which has not been well recorded in the literature to date. Finally, the relative difference in the number of cases performed between the 3 groups may have allowed for some statistical error with regard to our sample size. Overall, the NSQIP has been shown in the literature to be a high-quality database to study perioperative complications.[8,15,16,23,24,36,38]

CONCLUSION

Surgery for shoulder instability has a low rate of complication (arthroscopic Bankart, 0.3%; open Bankart, 1.0%; Latarjet-Bristow, 5.5%) in the early perioperative period, with the most common being surgical site infection, symptomatic DVT, and return to the operating room. While perioperative complications were generally higher after the Latarjet-Bristow procedure, this trade-off may be necessary to achieve a greater stability construct. Although these procedures are generally performed in an outpatient manner, it is still important for the surgeon and patient alike to be aware of the significant complications that may arise in the perioperative period and combine those data along with the individual shoulder pathology and reported long-term outcomes to best achieve successful outcomes.

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