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Comparison of perioperative complications following surgical treatment of shoulder instability

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Background: Surgical repair for shoulder instability includes arthroscopic Bankart, open Bankart, and Latarjet-Bristow.

Methods: This is a cohort study of patients who underwent arthroscopic Bankart, open Bankart, or Latarjet-Bristow procedures that were identified within the National Surgical Quality Improvement Program database (2007-2019). Unadjusted and adjusted analyses were performed ($\alpha = 0.05$). Outcomes included 30-day adverse events, readmission, and operative time.

Results: This study included 10,955 patients (9128 arthroscopic Bankart, 1148 open Bankart, and 679 Latarjet-Bristow). Compared with arthroscopic Bankart, Latarjet-Bristow had longer operative times (129.96 [95% CI: 126.49-133.43] vs. 86.35 [85.51-87.19] minutes), along with a higher percentage of serious adverse events (2.5% vs. 0.4%), reoperation (1.9% vs. 0.1%), readmission (1.8% vs. 0.3%), thromboembolic complications (0.4% vs. 0.1%), and sepsis (0.4% vs. 0.0%) ($P < .05$ for all). Open Bankart had longer operative times (98.17 [95.52-100.82] vs. 86.35 [85.51-87.19] minutes) and a higher percentage of sepsis (0.2% vs. 0.0%) ($P < .05$ both). Latarjet-Bristow had increased odds of a serious adverse event (odds ratio [OR]: 7.68 [4.19-14.07]), reoperation (OR: 17.32 [7.58-39.56]), readmission (OR: 5.73 [2.84-11.54]), and deep wound complications (OR: 14.98 [3.92-57.23]) ($P < .05$ for all). In comparing the relative utilization of arthroscopic versus open Bankart, arthroscopic Bankart increased (83.4% to 91.2%) while open Bankart decreased (16.6% to 8.8%) from the 2011-2013 time period to 2017-2019 ($P_{trend} < .001$).

Conclusion: In addition to a low complication rate, the relative utilization of arthroscopic Bankart increased compared with open Bankart over the past decade. Furthermore, Latarjet-Bristow was associated with a higher incidence of serious adverse events than arthroscopic Bankart.

Shoulder instability, most often anterior, is a common problem primarily affecting active individuals, especially contact sport athletes.[9,18,20,22,33,36] The estimated prevalence of glenohumeral dislocation is 2% to 8% in the general population.[37] Shoulder instability is rooted in the native architecture of the glenohumeral joint, which is comprised of a network of bone, muscle, and ligamentous structures.[18,29] The organization of these structures allows for increased range of motion, but with subsequent instability making it susceptible to dislocation. Furthermore, recurrent episodes of instability can result in more severe Bankart lesions, bony defects, and stretching/elongation of ligamentous structures resulting in compromised joint stabilization.[18,24]

Management of shoulder instability includes a spectrum of conservative and operative treatments. Multiple patient factors including age, activity level, and desired level of sports participation should be considered. In particular, the age at first dislocation is a significant prognostic factor. In patients younger than 20 years at initial dislocation, the rate of recurrent instability is 72%-100%.[18,32,37,41,54] Typically, conservative management includes closed reduction with a period of immobilization followed by physical therapy.[4,37] For patients in whom operative management is deemed appropriate (ie, high-demand athletes, those with large Hill-Sachs lesions, glenoid osseous defects, recurrent instability, those who underwent failed conservative management[4,13,19,34,39,54]), the most common surgical options for repair of shoulder instability include arthroscopic or open Bankart and the Latarjet-Bristow procedure. The choice of surgical approach

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should consider the anatomical pathology, capsular integrity, tissue quality, amount of bone loss, surgeon experience, and risk assessment tools such as the Instability Severity Index Score.[5,15,18,20,38,39,54] Specifically, glenoid bone loss has been closely associated with recurrent instability, with prior literature demonstrating that there is decreased stability and/or poor outcomes occurring in osseous defects ranging from at least 13.5% to 30%.[8,14,25,38,46,47,54] In general, for patients with recurrent instability and 0-10% bone loss with good tissue quality, the operative treatment is directed toward open or arthroscopic Bankart repair. However, for patients with 10%-20% glenoid bone loss, there is ongoing debate on the ideal operative approach, with both Bankart and Latarjet-Bristow as possible choices given the mixed critical glenoid bone loss value in the literature.[4,38,39,54] Thus, given the heterogeneity in surgical indications for intermediate glenoid bone loss, an understanding of the perioperative complications per procedure is a principal factor in decision-making regarding the operation. Lastly, Latarjet-Bristow is suggested for patients with >20% glenoid bone loss.[4,38,39,54]

Previously, the literature has demonstrated that Latarjet-Bristow procedures are associated with a higher incidence of complications than open and arthroscopic Bankart, ranging from 1.9% to 5.5%.[9,20] While the risk is still relatively low and the procedures are generally considered safe, complications with operative management can include, but are not limited to, infection, nerve injury, graft malposition, graft nonunion, and recurrent subluxation/dislocation.[9,16,17,21,22,26,31,35,40] Through this study, the authors are interested in specifically analyzing the perioperative complications associated with instability repair procedures by utilizing the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) registry. While previous studies have utilized the NSQIP database for similar outcome measures, the cohort of patients utilized in those analyses was limited by the availability of data at the time of publication.[9,20] Furthermore, as the shoulder instability repair landscape continues to evolve, there is a clinical demand to understand the shifts in complication rates and procedure utilization.

Therefore, this study aims to encompass the largest patient cohort and most recent NSQIP data to compare surgical risks and complications following shoulder stabilization procedures with either an arthroscopic Bankart, open Bankart, or Latarjet-Bristow approach. Furthermore, a secondary aim of this study includes investigating relative procedure trends in shoulder instability repairs. We anticipate that the information gained through this analysis will provide surgeons with the evidence essential to anticipating risks and potential adverse outcomes to guide their choice in surgical technique, especially for patients with overlapping operative indications.

Methods

Source data

This is a cohort study that utilized the NSQIP database to identify patients who underwent shoulder instability repair procedures from 2007 to 2019. The NSQIP tracks and audits 30-day perioperative outcomes of surgical patients across more than 700 medical institutions in the United States.[2,9,20,51,52] The accuracy of the results provided in the database has been validated and used to describe many orthopedic procedures to date.[6] The data are extracted by trained reviewers directly from the medical records, and NSQIP is considered one of the most accurate surgical databases currently available.[7,20,51] As the NSQIP data set is deidentified and contains no geographic markers, this study was exempt from local institutional review board review.

All patients included in this study were adults (age ≥18 years) from the NSQIP database who underwent shoulder instability procedures as described by the Current Procedural Terminology codes: open Bankart, 23455; arthroscopic Bankart, 29806; and Latarjet-Bristow, 23462. Baseline demographics included age, gender, body mass index (BMI), American Society of Anesthesiologists (ASA) class, race, diabetes mellitus, steroid use for chronic condition, smoking status, severe chronic obstructive pulmonary disease, congestive heart failure, and hypertension requiring medication. Adverse events were classified as serious or minor. Serious adverse events included death, reoperation, pulmonary complications (unplanned intubation or ventilator greater than 48 hours), pneumonia, cardiac complications (cardiac arrest or myocardial infarction), thromboembolic complications (deep vein thrombosis [DVT] or pulmonary embolism), renal complications (progressive renal insufficiency or acute renal failure), deep wound complications (deep surgical site infection, joint space infection, or wound dehiscence), and sepsis. Minor complications included urinary tract infection and superficial surgical site infection. Total operative time and readmission were also assessed. Additionally, trends in relative procedure rates and serious adverse event incidences per time category were investigated.

Statistical analysis

Statistical analyses were performed in SAS v9.4 (SAS Institute, Cary, NC, USA). Baseline unadjusted demographic variables and procedure outcomes were analyzed with t-tests or chi-squared/Fisher's exact tests, as appropriate. Adjusted analyses (multivariable logistic or linear regressions) controlled for all significant differences in baseline procedure demographics. All reported P values are 2-tailed, with the level of significance set at $\alpha = 0.05$.

Results

Unadjusted baseline demographics

There was a total of 10,955 patients (9128 arthroscopic Bankart, 1148 open Bankart, and 679 Latarjet-Bristow). As outlined in the unadjusted baseline demographics in Table I, significant differences between the three procedures were noted for age, gender, BMI, race, ASA category, diabetes mellitus, and smoking status ($P < .05$ for all). Compared with arthroscopic Bankart, patients undergoing a Latarjet-Bristow procedure were younger (28.93 [95% CI: 28.24-29.62] vs. 31.40 [31.15-31.65] years), a higher percentage of them were male patients (85.7%. vs. 77.7%), had lower mean BMI (27.17 [26.80-27.55] vs. 27.72 [27.61-27.83] kg/m^2), and a higher percentage of them were black (11.6% vs. 8.4%) ($P < .05$ for all). Furthermore, patients undergoing a Latarjet-Bristow procedure had a higher percentage of smoking within the past year (27.7 % vs. 20.3%) and a lower percentage of diabetes mellitus (0.9% vs. 3.1%) ($P < .05$ for both). Compared with arthroscopic Bankart, a higher percentage of patients undergoing an open Bankart were male (82.2% vs. 77.7%) and smoking within the past year (24.5% vs. 20.3%) ($P < .05$ for both). Furthermore, the open Bankart group had a lower percentage of black patients (7.2% vs. 8.4%) and patients with diabetes mellitus (2.0% vs. 3.1%) ($P < .05$ for both) (Table I).

Unadjusted analysis of postoperative complications

As outlined in the unadjusted outcomes in Table II, significant differences between the three procedures were noted for total operative time, serious adverse event rate, 30-day readmission, 30-day reoperation, deep wound complications, thromboembolic complications, and sepsis ($P < .05$ for all). Compared with

Table I
Unadjusted baseline demographics for patients undergoing arthroscopic Bankart, open Bankart, and Latarjet-Bristow procedures.

Demographics	Total	Arthroscopic Bankart	Latarjet-Bristow	*P* value*	Open Bankart	*P* value*
	(N = 10955)	(N = 9128)	(N = 679)		(N = 1148)	
Age, mean (95% CI)	31.22 (31.00-31.45)	31.40 (31.15-31.65)	28.93 (28.24-29.62)	<.001†	31.14 (30.44-31.83)	.48
Age categories				<.001†		.84
0-24	4089 (37.3%)	3395 (37.2%)	258 (38.0%)		436 (38.0%)	
25-34	3576 (32.6%)	2924 (32.0%)	281 (41.4%)		371 (32.3%)	
35-44	1758 (16.0%)	1483 (16.2%)	90 (13.3%)		185 (16.1%)	
45+	1532 (14.0%)	1326 (14.5%)	50 (7.4%)		156 (13.6%)	
Gender				<.001†		<.001†
Female	2341 (21.4%)	2040 (22.3%)	97 (14.3%)		204 (17.8%)	
Male	8614 (78.6%)	7088 (77.7%)	582 (85.7%)		944 (82.2%)	
BMI, mean (95% CI)	27.70 (27.60-27.80)	27.72 (27.61-27.83)	27.17 (26.80-27.55)	.006†	27.84 (27.51-28.17)	.49
BMI category				.20		.86
Normal (<24.9 kg/m^2)	3596 (32.8%)	2989 (32.7%)	240 (35.3%)		367 (32.0%)	
Overweight (25-29.9 kg/m^2)	4520 (41.3%)	3759 (41.2%)	281 (41.4%)		480 (41.8%)	
Obese (>30 kg/m^2)	2839 (25.9%)	2380 (26.1%)	158 (23.3%)		301 (26.2%)	
ASA, mean (95% CI)	1.61 (1.60-1.62)	1.61 (1.60-1.62)	1.64 (1.60-1.69)	.22	1.60 (1.56-1.63)	.45
ASA category				.038†		.11
1	5024 (45.9%)	4187 (45.9%)	284 (41.8%)		553 (48.2%)	
2	5189 (47.4%)	4325 (47.4%)	356 (52.4%)		508 (44.3%)	
3+	738 (6.7%)	612 (6.7%)	39 (5.7%)		87 (7.6%)	
Race				.016†		<.001†
Black	931 (8.5%)	769 (8.4%)	79 (11.6%)		83 (7.2%)	
Other	3019 (27.6%)	2365 (25.9%)	168 (24.7%)		486 (42.3%)	
White	7005 (63.9%)	5994 (65.7%)	432 (63.6%)		579 (50.4%)	
Diabetes mellitus	308 (2.8%)	279 (3.1%)	6 (0.9%)	.001†	23 (2.0%)	.046†
Steroid use (chronic condition)	67 (0.6%)	59 (0.6%)	1 (0.1%)	.13	7 (0.6%)	.88
Current smoker (within 1 yr)	2320 (21.2%)	1851 (20.3%)	188 (27.7%)	<.001†	281 (24.5%)	<.001†
Severe COPD	48 (0.4%)	42 (0.5%)	1 (0.1%)	.37	5 (0.4%)	.91
Congestive heart failure	3 (0.0%)	3 (0.0%)	0 (0.0%)	1.00	0 (0.0%)	1.00
Hypertension requiring medication	944 (8.6%)	806 (8.8%)	51 (7.5%)	.24	87 (7.6%)	.16

BMI, body mass index; *ASA*, American Society of Anesthesiologist; *CI*, confidence interval; *COPD*, chronic obstructive pulmonary disease.
*Reference: Arthroscopic Bankart.
†Statistically significant (α = 0.05).

Table II
Total operative time and incidence of postoperative complications by shoulder instability procedure type.

Operative time & complications	Total	Arthroscopic Bankart	Latarjet-Bristow	*P* value*	Open Bankart	*P* value*
	(N = 10955)	(N = 9128)	(N = 679)		(N = 1148)	
Total operation time, mean (95% CI)	90.29 (89.48-91.10)	86.35 (85.51-87.19)	129.96 (126.49-133.43)	<.001†	98.17 (95.52-100.82)	<.001†
30-d Readmission	45 (0.4%)	26 (0.3%)	12 (1.8%)	<.001†	7 (0.6%)	.09
Serious adverse event	56 (0.5%)	32 (0.4%)	17 (2.5%)	<.001†	7 (0.6%)	.20
Deep wound complication	10 (0.1%)	4 (0.0%)	5 (0.7%)	<.001†	1 (0.1%)	.45
Pulmonary complication	4 (0.0%)	4 (0.0%)	0 (0.0%)	1.00	0 (0.0%)	1.00
Renal complication	2 (0.0%)	1 (0.0%)	0 (0.0%)	1.00	1 (0.1%)	.21
Cardiac complication	2 (0.0%)	2 (0.0%)	0 (0.0%)	1.00	0 (0.0%)	1.00
Thromboembolic complication	12 (0.1%)	9 (0.1%)	3 (0.4%)	.045†	0 (0.0%)	.61
Sepsis	6 (0.1%)	1 (0.0%)	3 (0.4%)	.001†	2 (0.2%)	.035†
Pneumonia	10 (0.1%)	7 (0.1%)	2 (0.3%)	.12	1 (0.1%)	1.00
30-d Reoperation	28 (0.3%)	11 (0.1%)	13 (1.9%)	<.001†	4 (0.3%)	.08
Mortality	3 (0.0%)	3 (0.0%)	0 (0.0%)	1.00	0 (0.0%)	1.00
Minor complication	17 (0.2%)	13 (0.1%)	1 (0.1%)	1.00	3 (0.3%)	.41
Urinary tract infection	6 (0.1%)	6 (0.1%)	0 (0.0%)	1.00	0 (0.0%)	1.00
Superficial surgical site infection	11 (0.1%)	7 (0.1%)	1 (0.1%)	.44	3 (0.3%)	.09

*Reference: Arthroscopic Bankart.
†Statistically significant (α = 0.05).

arthroscopic Bankart, patients undergoing a Latarjet-Bristow procedure had longer total operative times (129.96 [126.49-133.43] vs. 86.35 [85.51-87.19] minutes), along with a higher percentage of serious adverse events (2.5% vs. 0.4%), 30-day reoperation (1.9% vs. 0.1%), 30-day readmission (1.8% vs. 0.3%), thromboembolic complications (0.4% vs. 0.1%), and sepsis (0.4% vs. 0.0%) ($P < .05$ for all). Compared with arthroscopic Bankart, patients undergoing an open Bankart procedure had longer total operative times (98.17 [95.52-100.82] vs. 86.35 [85.51-87.19] minutes) and a higher percentage of sepsis (0.2% vs. 0.0%) ($P < .05$ for both) (Table II).

Adjusted analysis of postoperative complications

The adjusted analysis controlled for age, gender, BMI, ASA class, race, diabetes mellitus, smoking status, and operation year. Compared with arthroscopic Bankart, patients undergoing a Latarjet-Bristow procedure had increased odds of a serious adverse event (odds ratio [OR]: 7.68 [4.19-14.07]), 30-day reoperation (OR: 17.32 [7.58-39.56]), 30-day readmission (OR: 5.73 [2.84-11.54]), wound complication (OR: 14.98 [3.92-57.23]), and sepsis (OR: 37.53 [3.85-365.84]) ($P < .05$ for all). Compared with arthroscopic

Table III
Adjusted analysis of perioperative complications (controlling for age, gender, BMI, ASA class, race, diabetes mellitus, smoking status, and operation year) with reference to arthroscopic Bankart.

	Latarjet-Bristow			Open Bankart		
	OR	95% CI	P value*	OR	95% CI	P value*
30-d Readmission	5.73	2.84-11.54	<.001†	2.11	0.90-4.94	.09
Serious adverse event	7.68	4.19-14.07	<.001†	1.68	0.73-3.86	.22
30-d Reoperation	17.32	7.58-39.56	<.001†	2.89	0.91-9.22	.07
Deep wound complication	14.98	3.92-57.23	<.001†	1.97	0.22-17.97	.55
Pulmonary complication	-	-	-	-	-	-
Renal complication	-	-	-	7.22	0.38-137.80	.19
Cardiac complication	-	-	-	-	-	-
Thromboembolic complication	4.62	1.22-17.55	.0245†	-	-	-
Sepsis	37.53	3.85-365.84	.0018†	15.70	1.38-178.69	.0264†
Pneumonia	3.76	0.77-18.49	.10	1.00	0.12-8.37	1.00
Death	-	-	-	-	-	-
Minor complication	1.47	0.19-11.49	.71	1.31	0.36-4.79	.68
Urinary tract infection	-	-	-	-	-	-
Superficial surgical site infection	2.35	0.28-19.73	.43	2.27	0.56-9.25	.25

BMI, body mass index; *ASA*, American Society of Anesthesiologist; *CI*, confidence interval; *OR*, odds ratio.
*Reference: Arthroscopic Bankart.
†Statistically significant ($\alpha = 0.05$).

Bankart, patients undergoing an open Bankart had increased odds of sepsis (OR: 15.70 [1.38-178.69]) ($P < .05$) (Table III).

Procedure trends

In comparing the relative utilization of arthroscopic versus open Bankart, the use of arthroscopic Bankart significantly increased from 83.4% (2011-2013) to 91.2% (2017-2019) compared with that of open Bankart, which decreased from 16.6% to 8.8% over that time ($P_{trend} < .001$). In assessing trends in complications, the incidence of serious adverse events for arthroscopic Bankart was <1% at each time category, ranging from 0.63% in 2007-2010 to 0.34% in 2017-2019 ($P_{trend} = .35$). For open Bankart, the trend of serious adverse events nonsignificantly decreased from 1.67% in 2007-2010 to 0.44% in 2017-2019 ($P_{trend} = .44$). Lastly, there was a near-significant decrease in serious adverse events following Latarjet-Bristow procedures, which decreased from 11.76% in 2007-2010 to 1.36% in 2017-2019 ($P_{trend} = .052$) (Fig. 1).

Discussion

Through utilization of the widely recognized and validated NSQIP database, this study analyzed the perioperative complications associated with shoulder instability repairs by arthroscopic Bankart, open Bankart, and Latarjet-Bristow from 2007 to 2019. We found that the relative percentage of arthroscopic Bankart repairs has significantly increased compared with open Bankart since 2011, likely a result of its low complication rate, shorter operative time, and minimally invasive approach. Furthermore, previous literature has demonstrated that surgical intervention results in a significantly lower rate of recurrent instability in first-time dislocations than nonoperative management,[10,11,27,41,54] thus potentially contributing to the relative increase in the popularity of arthroscopic Bankart over the past decade. Moreover, patients undergoing an arthroscopic Bankart procedure demonstrated a serious adverse event incidence of <1% in all time categories. Additionally, Latarjet-Bristow was associated with a higher incidence of serious adverse events than arthroscopic Bankart.

In accordance with previous literature, this study demonstrated that the Latarjet-Bristow procedure was associated with a higher total incidence of serious adverse events (2.5%) than arthroscopic Bankart repair (0.4%). Goodloe et al[20] and Bokshan et al[9] demonstrated total complication rates of 1.9% and 5.5%, respectively, for Latarjet-Bristow. Additionally, Goodloe et al[20] showed through univariate and multivariate analyses that patients undergoing a Latarjet-Bristow repair were approximately 8 and 9 times more likely to have a complication, respectively, than those undergoing arthroscopic Bankart. Similarly, through the incorporation of more recent NSQIP data and accounting for baseline demographic differences, the adjusted analysis performed in this study demonstrated an almost 8 times greater increase in the odds of a complication for Latarjet-Bristow than for arthroscopic Bankart. Furthermore, the Latarjet-Bristow cohort had a significantly greater total operative time than the arthroscopic Bankart group, which confirms the previous results of Bokshan et al.[9] Per the literature, increased total operative time increases the likelihood of postoperative complications, with a 14% increase for every 30 minutes of additional operating time.[12] Notably, however, Laboute et al[28] reported that Latarjet procedures result in a significantly lower risk of instability recurrence and a higher rate of return to sport than arthroscopic Bankart. Additionally, in long-term follow-up, Hovelius et al[23] reported that Latarjet-Bristow procedures had better stability than open Bankart repairs with suture anchors. Thus, while still taking the increased surgical risks into consideration,[43] physicians should not discount the benefits of Latarjet-Bristow procedures, especially for patients with significant glenoid bone loss.

In terms of infection, there were significant differences noted for Latarjet-Bristow and open Bankart procedures compared with arthroscopic Bankart in the unadjusted analyses. For instance, there was a significantly greater incidence of deep wound complications and sepsis for patients undergoing Latarjet-Bristow procedures. Furthermore, patients undergoing an open Bankart repair experienced a greater incidence of sepsis than those undergoing arthroscopic Bankart. In the adjusted analysis, patients undergoing a Latarjet-Bristow procedure were approximately 15 times more likely to experience a deep wound complication. Additionally, similar to this current study, Goodloe et al[20] stated that there was no statistically significant difference in superficial site infections between the three stabilization types. However, Goodloe et al[20] noted that there was a significant difference in deep-site infections between the three procedure types, with Latarjet-Bristow having the greatest incidence of 0.4%. Furthermore, Goodloe et al[20] stated that patients were about 25 times more likely to develop a deep site infection with Latarjet-Bristow than with arthroscopic Bankart. Previous literature has also demonstrated that the rate of

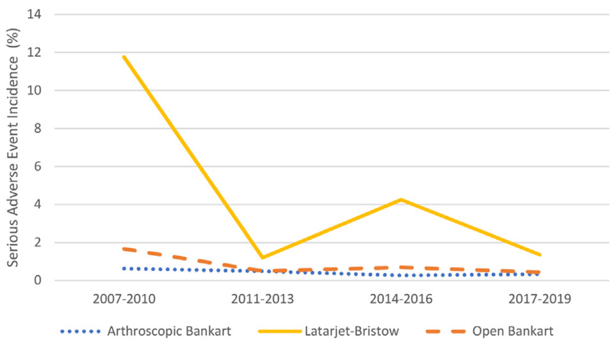

Figure 1 Nonsignificant trends of serious adverse event incidences per stabilization procedure type

infection after arthroscopic and open Bankart repair was 0.22% and 0.33%, respectively.[9,35] Therefore, through the incorporation of more recent NSQIP data, this study reaffirms the increased rate of deep wound complications with Latarjet-Bristow procedures.

For the Latarjet-Bristow procedure type, there was a significantly greater incidence of thromboembolic complications (0.4%) than for arthroscopic Bankart repairs. Additionally, the adjusted analysis demonstrated that patients undergoing a Latarjet-Bristow procedure were almost 5 times more likely to experience a thromboembolic complication. These data coincide with the previous study performed by Goodloe et al[20] that demonstrated that the Latarjet-Bristow cohort had a significantly greater DVT incidence than the arthroscopic Bankart repair group. However, compared with the current study, Goodloe et al[20] reported a higher DVT incidence of 0.8%. Moreover, Goodloe et al[20] stated that patients undergoing Latarjet-Bristow repair were 10 times more likely to develop a DVT than those undergoing arthroscopic Bankart. Notably, a prior retrospective review performed by Schick et al[45] demonstrated that venous thromboembolism uncommonly occurs at a rate of 0.15% following shoulder arthroscopy. Thus, while the data demonstrate that the risk of DVT is low for stabilization procedures,[20,30,45] the resulting effect can be detrimental and health-care providers should be aware of the risk when undergoing surgical intervention.

Notably, in this current study, the Latarjet-Bristow and open Bankart cohorts had a significantly larger proportion of active smokers than the arthroscopic Bankart group. Additionally, for Latarjet-Bristow procedures, Bokshan et al[9] showed that smoking was a risk factor for a perioperative complication. However, Goodloe et al[20] reported that smoking status produced a nonsignificant difference in the odds of developing a complication. For orthopedic procedures, smoking has been shown to cause impaired wound healing, augmented infection, and delayed or no fracture union.[3,9,42,44,48,49,53] Furthermore, smoking has been shown to have a dose-dependent effect on bone loss.[53] Therefore, patients should be counseled on smoking cessation to minimize complications and optimize outcomes.

Lastly, patients undergoing a Latarjet-Bristow procedure had a 30-day reoperation and readmission rates of 1.9% and 1.8%, respectively, which were significantly greater than those for arthroscopic Bankart (0.1% and 0.3%, respectively). Furthermore, in the adjusted analysis, Latarjet-Bristow was associated with an almost 6 times increase in the odds of readmission, along with a 17 times increase in the likelihood of reoperation. Bokshan et al[9] demonstrated that the highest 30-day reoperation rate was 4.3% for the Latarjet-Bristow procedure. Goodloe et al[20] illustrated a significant incidence of 1.7% for Latarjet-Bristow repairs returning to the operating room in 30 days, along with being 11 times more likely to return to the operating room than arthroscopic Bankart procedures. Therefore, while the incidence of 30-day reoperation for Latarjet-Bristow has remained stable with the incorporation of more recent NSQIP data, there is still a significantly greater risk than arthroscopic Bankart repairs.

Limitations

While this study benefits from the most recent time range and the largest sample size compared with previous NSQIP studies addressing shoulder instability, it is not without limitations. Based on the utilization of the NSQIP database, this study includes common limitations previously reported in the literature. For instance, the NSQIP data are limited to an initial 30-day postoperative period, limiting the ability to capture complications outside this time period.[9,20] Also, the database is restricted in its ability to assess surgeon experience, hospital volume, preoperative assessment parameters (ie, radiographs, bone loss measurements, Instability Severity Index Score, and so on), procedure-specific details (ie, number and type of anchors, sutures, screws, and so on), and does not include outpatient surgery centers.[9,20] Furthermore, the Current Procedural Terminology code utilized for arthroscopic Bankart encompasses all types of shoulder instability (not just anterior), thus specific directional terms were limited throughout the study. Additionally, postoperative therapy protocols are not evaluated on NSQIP, which can significantly affect the incidence of perioperative complications, for example DVT.[9] Critically, given the rarity of certain specific complications (e.g., pulmonary, renal, cardiac, and so on), adjusted analyses could not be reliably performed. Relatedly, any lack of significance among specific complications should be considered in light of limited power. To overcome this limitation, composite outcomes (e.g., serious adverse events) are provided, as is standard practice when working with rare outcomes, including in the NSQIP database.[50] Despite these limitations, the NSQIP database has been shown to provide a source of accurate, high-quality, validated information for evaluating 30-day perioperative complications.[1,7,9,20,51]

Conclusion

As the shoulder instability repair landscape continues to evolve, it is imperative to evaluate procedure trends and safety. Specifically, in addition to a low complication rate, the relative utilization of arthroscopic Bankart increased compared with that of open Bankart over the past decade. Furthermore, Latarjet-Bristow was associated with a higher incidence of serious adverse events than arthroscopic Bankart. Overall, the information gained through this study offers health-care providers with the most up-to-date and all-inclusive evaluation of shoulder instability repair perioperative complications—data that are essential to assessing risk and optimizing patient outcomes.

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