Early Complication Rates Following Total Shoulder Arthroplasty for Instability Arthropathy With a Prior Coracoid Transfer Procedure

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abstract

The purpose of this study was to report early complications for anatomic total shoulder arthroplasty (aTSA) performed for instability arthropathy after a prior coracoid transfer procedure and compare them with those of a control group of patients following aTSA for primary osteoarthritis. A retrospective review was performed of 14 patients after aTSA with a prior coracoid transfer procedure. A control group of 42 patients with an aTSA for primary osteoarthritis were matched 3:1 according to age, sex, body mass index, comorbidities, and dominant shoulder. Chart reviews identified any complications within 1 year, in addition to blood loss and operative time in both groups. Preoperative computed tomography scans were used to determine Walch glenoid classification and Goutallier classification of the subscapularis. The mean operative time was not significantly different between the coracoid transfer cohort and the control group, and the mean estimated blood loss was only 6.9 mL greater in the coracoid transfer group. The coracoid transfer group had 2 (14.3%) patients with complications, with 1 early revision for an acute deep infection. The control group had 4 (9.5%) complications in 3 (7.1%) patients, with no early revisions. There was no statistical difference in complications between the groups (*P*=.618). Anatomic TSA for instability arthropathy after coracoid transfer had similar operative time, blood loss, and 1-year complication rates as those of the control group. These results provide some evidence to support the continued use of aTSA in select patients with instability arthropathy after prior coracoid transfer procedure. [*Orthopedics*. 2021;44(4):e482-e486.]

Instability arthropathy is a well-known condition that can occur following shoulder instability treated nonoperatively, with soft tissue reconstructive procedures, and following coracoid transfer procedures.[1-3] Coracoid transfers (Latarjet or Bristow) have become increasingly popular in the United States, and it is therefore anticipated that a higher number of patients will present for total shoulder arthroplasty (TSA) in the setting of instability arthropathy.[4,5]

There are known technical difficulties of performing anatomic TSA (aTSA) following coracoid transfer. The exposure is

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Dr Bender, Dr Laughlin, Dr Sheth, Dr Budeyri, Mr Le, and Dr Elkousy have no relevant financial relationships to disclose. Dr Morris is a paid consultant for Wright Medical Group; has received research support from Wright Medical Group and Tornier; and has received an honorarium from DJ Orthopedics. Dr Edwards is a paid consultant for Wright Medical Technology, DJ Orthopedics, and Smith & Nephew and receives royalties from Wright Medical Technology.

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Received: February 7, 2020; Accepted: May 4, 2020.

doi: 10.3928/01477447-20210618-04

difficult due to loss of the coracoid and conjoined tendon as surgical identifiers, scar tissue, and abnormal neurovascular structure location.[6,7] In addition, selection of aTSA vs reverse total shoulder arthroplasty (RSA) is currently debated for these patients. Part of the controversy is related to the splitting or takedown of the subscapularis at the time of index coracoid transfer procedure and potential subscapularis insufficiency at the time of TSA. This controversy is in part fueled by prior studies that have demonstrated a high rate of recurrent instability, soft tissue failure, and early component loosening with aTSA after coracoid transfer.[8] As a result, some researchers and clinicians have advocated for RSA. However, the benefits of RSA are weighed against questions about its durability. The question of durability is even more relevant in instability arthropathy patients, who tend to present at younger ages.[1,9-12]

There are limited studies examining early complications of aTSA after prior coracoid transfer procedures.[1,9,11,12] In addition, it is the authors' anecdotal experience that aTSA performed for instability arthropathy after prior coracoid transfers perform well and are associated with similar complication rates, operative time, and blood loss compared with more routine aTSA cases.

The purpose of this study was to report the early complications for aTSA performed for instability arthropathy after a prior coracoid transfer procedure and compare them with those of a control group of aTSAs performed for primary osteoarthritis. The authors hypothesized that aTSA after a prior coracoid transfer procedure would not have a significantly increased rate of complications, blood loss, or operative time relative to aTSA for primary osteoarthritis.

Materials and Methods

A retrospective review with a comparative cohort (control group) was performed on the authors' single-surgeon (T.B.E.) TSA registry database after obtaining institutional review board approval. All patients completed informed consent prior to enrolling in the database. Data were prospectively collected from December 2004 to February 2018.

Inclusion Criteria

Patients with a prior coracoid transfer (Bristow or Latarjet procedure) completed for anterior shoulder instability and a subsequent primary aTSA performed for instability arthropathy were included. Patients with rotator cuff tears, fixed dislocations, posterior shoulder instability, prior glenoid bone grafting from sources other than the coracoid, hemiarthroplasty (HA), or RSA as the index procedure were excluded. Also excluded were patients with coracoid transfers performed simultaneously at the time of arthroplasty.

Patient Selection

A robust cohort of 2887 patients in the TSA registry were assessed, and 132 (4.6%) patients had undergone TSA for a diagnosis of "instability arthropathy" or "capsulorrhaphy arthropathy." The authors conducted a comprehensive review of clinical notes, operative reports, and radiographs to identify 14 patients with aTSA performed for instability arthropathy after a prior coracoid transfer procedure. This represented less than 1% of the TSAs included in the registry.

Control Group

Patients undergoing aTSA for primary osteoarthritis were extracted from the TSA registry for potential inclusion in a matched control group. Each coracoid transfer case was matched with 3 control subjects using propensity scoring and matched according to age, sex, body mass index (BMI), shoulder dominance, and comorbidities with a nearest neighbor technique used for surgery date to account for changes in surgical technique over time.[13]

Clinical Data Collection

A comprehensive chart review was performed for both groups to identify demographics, operative time, blood loss, complications, or revisions that occurred within 1 year following aTSA. At the authors' institution, operative time is recorded from incision to sling placement. Blood loss was estimated by the anesthesiologist and surgeon, and any discrepancies were resolved by averaging the 2 values. The integrity of the subscapularis repair preoperatively was determined based on clinical examination and advanced imaging with preoperative computed tomography (CT) with arthrogram.

Preoperative images were used to evaluate glenoid wear pattern and rotator cuff fatty infiltration. Glenoid wear pattern was assessed on the preoperative CT arthrogram based on the classification by Walch et al.[14] The grade of fatty infiltration was based on the classification described by Goutallier et al.[15]

Surgical Technique

The 14 prior coracoid transfer cases were performed through a deltopectoral approach, using a well-described surgical technique that the authors use on all TSA cases.[16] The subscapularis was noted to be intact in all cases. In all cases, a subscapularis tenotomy was performed along the anatomical neck. Retained screws were removed in 12 of the 14 cases. The screws were removed if they were loose or interfered with glenoid placement. A cemented all-polyethylene glenoid and a press-fit humeral stem were used in all cases. Humeral components used included 3 Aequalis, 1 Ascend, and 8 Ascend Flex stems (Tornier/Wright Medical) and 2 Altivate stems (DJO Surgical). Glenoid components used included 1 Aequalis keeled, 3 Aequalis pegged, and 8 Perform Cortiloc pegged glenoids (Tornier/Wright Medical) and 2 Altivate e+ glenoids (DJO Surgical).

The 42 aTSAs in the primary osteoarthritis cohort were performed with a deltopectoral approach and a subscapularis tenotomy as described.[16] Humeral press-fit implants were used in all cases, including 20 Aequalis, 7 Ascend, and 15 Ascend

Table 1

Patient Characteristics

Characteristic	Coracoid transfer group (n=14)	Primary osteoarthritis control group (n=42)	*P*
Age, mean±SD, y	56.7±4.2	57.1±5.0	.824
Sex, male:female, No.	13:1	39:3	>.99
Body mass index, mean±SD, kg/m^2	28.8±5.6	29.2±4.4	.749
Dominant shoulder, No.	7 (50.0%)	21 (50.0%)	>.99

Table 2

Preoperative Computed Tomography Data

	No.		
Classification	Coracoid transfer group (n=14)	Primary osteoarthritis control group (n=42)	*P*
Walch classification			.712
A1	4 (28.6%)	16 (38.1%)	
A2	2 (14.3%)	5 (11.9%)	
B1	4 (28.6%)	6 (14.3%)	
B2	4 (28.6%)	11 (26.2%)	
C	0 (0.0%)	2 (4.8%)	
Missing	0 (0.0%)	2 (4.8%)	
Goutallier grade of subscapularis			.344
0	10 (71.4%)	39 (92.9%)	
1	1 (7.1%)	1 (2.4%)	
2	1 (7.1%)	0 (0.0%)	
3	2 (14.3%)	0 (0.0%)	
4	0 (0.0%)	0 (0.0%)	
Missing	0 (0.0%)	2 (4.8%)	

Flex stems (Tornier/Wright Medical). Cemented all-polyethylene glenoids used included 12 Aequalis keeled, 13 Aequalis pegged, and 17 Perform Cortiloc glenoids (Tornier/Wright Medical).

Statistical Analysis

A matched linear mixed model was used to test for differences between the coracoid transfer group and the control group for estimated blood loss, operative time, and complications. Chi-square tests were used to evaluate Walch and Goutallier classifications. Statistical significance was set at $P<.05$. SPSS, version 24, software (IBM Corp) was used for all analyses.

Results

There were no statistically significant differences in age, sex, BMI, and shoulder dominance between the 2 groups (**Table 1**). Of note, the coracoid transfer group was predominantly male (n=13), with only 1 female. Eleven (78.6%) patients had a prior Bristow and 3 (21.4%) patients had a prior Latarjet. Seven (50.0%) patients had 1 or more soft tissue surgeries prior to coracoid transfer, and 3 (21.4%) patients had 2 or more. The mean interval from coracoid transfer to aTSA was 29 years (range, 2-44 years). Loose screws were identified in 6 patients, and 1 patient had a broken screw. Overall, retained screws were removed in 12 of the 14 cases. A coracoid nonunion was present in 3 of the Bristow procedures.

A preoperative CT scan was available for review for all patients in the coracoid transfer group and 40 (95.2%) of 42 patients in the control group (**Table 2**). Glenoid morphology was classified for each patient (**Table 2**), and there were no statistically significant differences between groups ($P=.712$). Fatty infiltration of the subscapularis was evaluated using the Goutallier classification.[15] There was no statistically significant difference regarding Goutallier classification of the subscapularis between groups ($P=.344$). The numbers of patients with Goutallier grade 0 in the coracoid transfer group (10 of 14; 71.4%) and the control group (39 of 42; 92.9%) were comparable; however, 3 (21.4%) of 14 coracoid transfer patients were graded a 2 or 3, compared with 0 of 42 patients in the control group.

Surgical data for the 2 cohorts are presented in **Table 3**. The mean operative time was not significantly different between the coracoid transfer group and the control group (90.6±14.3 minutes vs 92.2±19.6 minutes; $P=.770$), and the mean estimated blood loss was only 6.9 mL greater in the coracoid transfer group (162.9±76.3 mL vs 156.0±61.9 mL; $P=.727$).

There were 2 complications and 1 early revision in the coracoid transfer group (**Table 4**). Both complications were infections, with 1 being superficial and 1 being deep. The early revision was in the patient with a deep infection. Of note, there were no nerve injuries, intraoperative complications, fractures, or acute subscapularis failures in the coracoid transfer group within 1 year of aTSA. The control group had 4 complications in 3 patients, with no early revisions. The complications in the control group included 1 superficial infection, 1 small intraoperative glenoid

fracture (no treatment indicated), and 2 neuropraxic injuries that resolved with observation. There was no statistical difference in the total number of complications between the groups (*P*=.618).

Discussion

This investigation analyzed a single surgeon's experience with aTSA after a coracoid transfer procedure in 14 patients. The overall rate of early complications (defined as occurring within 1 year) and operative data were reported and compared with a 3:1 control group of patients undergoing aTSA for primary osteoarthritis. There was no statistically significant difference in the complication rate between the coracoid transfer group (2 of 14; 14.3%) and the control group (4 of 42; 9.5%). This analysis was limited by the relatively small number of patients in the coracoid transfer group. The complications in the coracoid transfer group included 1 superficial infection and 1 deep infection, which may reflect the known increased risk of infection when operating at the same surgical site.[17]

Of note, there were no early dislocations or subscapularis failures. This finding provides some evidence to challenge the universal use of RSA in patients with a prior coracoid transfer based on the concern for subscapularis insufficiency. Prior studies have identified no difference in subscapularis fatty infiltration or atrophy but demonstrate varying results on clinical strength and endurance testing.[18-20] The current authors found no statistically significant differences in the prevalence of Goutallier stage 0 subscapularis fatty infiltration[15]; however, 3 of 14 prior coracoid transfer patients were graded as stage 2 or 3. Longer follow-up is required to determine the clinical significance of this finding.

To the best of the authors' knowledge, no studies have compared patients with a prior coracoid transfer with primary osteoarthritis patients, nor have there been studies specifically examining early complications of arthroplasty outcomes. Willemot et al[8] reported their experience with 19 patients who underwent aTSA (n=9), RSA (n=7), or HA (n=3) with prior coracoid transfers at a minimum 2-year follow-up (mean, 3.9±3.2 years). They found 4 (44.4%) instability-related complications in the aTSA group but did not specify when these occurred during the postoperative course.[8] Although there are other studies examining TSA outcomes after surgical treatment for shoulder instability,[1,9,11,12] these all include a majority of patients who underwent soft tissue reconstruction procedures and do not differentiate complications based on prior instability treatment.

Numerous authors have commented on the complexity of the approach and soft tissue balancing due to scarring in the subdeltoid space and conjoined tendon.[1,8,9,21] There is also displacement of neurovascular structures that make them vulnerable to injury. Freehill et al[6] conducted an anatomical study to identify changes to neurovascular anatomy after a Latarjet procedure and found clinically significant changes to the position of the musculocutaneous and axillary nerves.

The current authors examined these concerns using operative time and blood loss as surrogates for case complexity, especially in comparison with the more routine primary osteoarthritis patient. They found comparable operative times and blood loss between the 2 groups, and no neurovascular injuries in the coracoid transfer group. This finding was limited by all cases being performed by a single, high-volume TSA surgeon. Thus, they may not

Table 3

Surgical Data

Parameter	Mean±SD		*P*
	Coracoid transfer group	Primary osteoarthritis control group	
Estimated blood loss, mL	162.9±76.3	156.0±61.9	.727
Operative time, min	90.6±14.3	92.2±19.6	.770

Table 4

Early Complications and Revisions

Parameter	No.		*P*
	Coracoid transfer group (n=14)	Primary osteoarthritis control group (n=42)	
All complications	2 in 2 (14.3%) patients	4 (9.5%) in 3 (7.1%) patients	.618
Superficial infection	1 (7.1%)	1 (2.4%)	
Deep infection	1 (7.1%)	0 (0.0%)	
Nerve injury	0 (0.0%)	2 (4.8%)	
Fracture	0 (0.0%)	1 (2.4%)	
Dislocation	0 (0.0%)	0 (0.0%)	
Subscapular fracture	0 (0.0%)	0 (0.0%)	
Blood transfusion	0 (0.0%)	0 (0.0%)	
Deep venous thrombosis/pulmonary embolism	0 (0.0%)	0 (0.0%)	
Early revision	1 (7.1%)	0 (0.0%)	

reflect the experience of a surgeon with less experience, and these cases should continue to be approached with caution.

The findings of this study provide some evidence to support the use of aTSA and counter the universal use of RSA for instability arthropathy following coracoid transfers. This is relevant given the study by Willemot et al[8] that found, with notably small subgroups of 9 aTSA and 7 RSA patients, lower complication rates with RSA and that the majority of aTSA complications were related to prosthetic instability. Despite this finding, the instability arthropathy population presents at a younger age, with most studies reporting mean ages in the 40s and 50s[1,9-12,21]; RSA may continue to be considered in select cases, especially if there are any concerns with the status of the subscapularis, but questions remain regarding its durability and poor salvage options, especially in these younger patients. Currently, there is insufficient evidence to support the universal use of RSA for patients with instability arthropathy following a coracoid transfer, and this study has provided some evidence for similar early complication rates between aTSA for these patients compared with routine aTSA for primary osteoarthritis. Larger, multicenter studies are needed to better understand this small patient population.

There were limitations to this study. Most notably, the small cohort of patients in the coracoid transfer group may not have captured the full range and frequency of complications in these patients. The group's size likely reflects the infrequency of coracoid transfer procedures in the United States during the past 15 years. In addition, the complication rates reported in this study reflect 1-year clinical follow-up with no patient-reported outcome measures included. Furthermore, the experience of the single, high-volume TSA surgeon may not be generalizable to all surgeons.

Conclusion

Anatomic TSA for instability arthropathy after coracoid transfer had operative time, blood loss, and 1-year complication rates similar to those of the control group. These results provide some evidence to support the continued use of aTSA for select patients with instability arthropathy after prior coracoid transfer procedure. Larger studies are needed to understand these patients, who are expected to increase in number due to the increased use of coracoid transfers in the United States.

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