Original Article

Prior Acromioplasty Provides Similar Outcomes and Rate of Postoperative Complications Including Acromial Fracture After Reverse Total Shoulder Arthroplasty: A Retrospective Matched-Cohort Analysis

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Purpose: To compare outcomes of reverse total shoulder arthroplasty (RTSA) in patients with prior arthroscopic acromioplasty versus a control group of patients with no history of acromioplasty. **Methods:** We performed a retrospective matched-cohort study of patients from a single institution who underwent RTSA with a history of acromioplasty from 2009 to 2017 with a minimum 2-year follow-up period. Patients' clinical outcomes were evaluated using the American Shoulder and Elbow Surgeons shoulder score and Simple Shoulder Test, visual analog scale, and Single Assessment Numeric Evaluation surveys. Postoperative radiographs and patient charts were reviewed to determine whether patients sustained a postoperative acromial fracture. Charts were reviewed to determine range of motion and postoperative complications. Patients were matched on a 1:1 basis to a cohort of patients who underwent RTSA without a history of acromioplasty, and comparisons were performed using *t* and χ^2 tests. **Results:** Forty-five patients who underwent RTSA with a history of acromioplasty met the inclusion criteria and completed the outcome surveys. There were no significant differences between cases and controls in post-RTSA American Shoulder and Elbow Surgeons, visual analog scale, Simple Shoulder Test, or Single Assessment Numeric Evaluation outcome scores. There was no difference in the postoperative acromial fracture rate between cases and controls ($P = .577$). Overall, more complications occurred in the study group (n = 6, 13.3%) compared with the control group (n = 4, 8.9%); however, this difference was not statistically significant ($P = .737$). **Conclusions:** After RTSA, patients who have undergone a prior acromioplasty have similar functional outcomes without a significant difference in the rate of postoperative complications compared with patients with no history of acromioplasty. Furthermore, previous acromioplasty does not increase the risk of acromial fracture after RTSA. **Level of Evidence:** Level III, retrospective comparative study.

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Reverse total shoulder arthroplasty (RTSA) is an effective option to treat a range of shoulder conditions, including glenohumeral osteoarthritis and rotator cuff tear arthropathy.[1,2] In patients presenting with rotator cuff tear arthropathy, RTSA has been shown to lead to significant clinical improvements in postoperative pain, function, and active forward flexion.[3] The overall rate of complications after RTSA has been reported as between 1.4% and 28%[4]; these complications include rare but potentially devastating stress fractures of the acromion and scapular spine. The incidence of acromial and scapular spine stress fractures after RTSA has been reported as up to 10%.[5] Preoperative patient factors including female sex, osteoporosis, and acromial anatomy, as well as the biomechanical changes and excess stress placed on the acromion inherent to RTSA, have been identified as risk factors.[5]

Since arthroscopic acromioplasty was first introduced by Neer in 1972,[6] its incidence has increased significantly, especially as a concomitant procedure in the management of rotator cuff tears.[7] Modification of the acromial morphology through acromioplasty reduces mechanical impingement and the risk of rotator cuff retear.[7,8] However, despite the popularity of acromioplasty, its effectiveness remains debated in the literature.[7]

To date, outcomes after RTSA in patients with a history of acromioplasty remain poorly investigated. The purpose of this study was to compare outcomes of RTSA in patients with prior arthroscopic acromioplasty versus a control group of patients with no history of acromioplasty. We hypothesized that patients with prior acromioplasty who underwent RTSA would have significant improvements in clinical outcomes with no increased risk of acromial fracture compared with controls.

Methods

Institutional board review approval was obtained for this retrospective matched-cohort study (No. 20E.420). Patients from a single institution who underwent RTSA with a history of arthroscopic acromioplasty from January 1, 2009, to December 31, 2017, with a minimum 2-year follow-up period were identified. The exclusion criteria included patients who underwent hemiarthroplasty, revision of anatomic total shoulder arthroplasty to RTSA, or anatomic total shoulder arthroplasty. The exclusion criteria regarding the acromioplasty procedures included concomitant rotator cuff repair. Patients were contacted by email and by telephone to complete outcome surveys.

The primary outcomes were the postoperative American Shoulder and Elbow Surgeons (ASES) shoulder outcome score assessed through patient surveys and the incidence of postoperative acromial and scapular spine fractures after RTSA determined by radiographs and chart review. To assess secondary outcome measures, charts were reviewed to identify post-RTSA complications including infection, instability, and reoperation, and additional outcome surveys were administered to obtain postoperative Simple Shoulder Test (SST), visual analog scale (VAS), and Single Assessment Numeric Evaluation (SANE) scores. Furthermore, preoperative and postoperative range-of-motion (ROM) measurements of active forward elevation and external rotation, as well as the time elapsed between surgery and final ROM measurement, were obtained through chart review.

Patients were then matched on a 1:1 basis according to age, sex, date of surgery, indication for surgery (i.e., rotator cuff arthropathy or glenohumeral osteoarthritis), and BMI to a cohort of 45 patients who underwent RTSA without a history of acromioplasty. These groups were compared to determine any differences in clinical outcome scores or number of postoperative acromial fractures.

Statistical Analysis

Normality was assessed by performing the Shapiro-Wilk test. For the calculation of P values, the t test or Mann-Whitney U test was performed for continuous data and the χ^2 test was performed for categorical data. The level of significance was set at $P < .05$.

Results

A total of 56 patients were initially identified; however, only 45 patients (80.4%), consisting of 21 male and 24 female patients, completed the outcome surveys and were therefore included in the study. Of the 11 patients who were not included, 6 (10.7%) declined to participate and 5 (8.9%) never responded to emails or telephone calls. The 45 included patients were matched to 45 control patients who underwent RTSA without a history of acromioplasty and completed outcome surveys at a minimum of 2 years' follow-up. Pre-RTSA ASES, VAS, SST, and SANE outcome scores could not be obtained. After RTSA, there was no significant difference in these scores between the cases and controls (Table 1). The average follow-up period for the outcome surveys was 52.6 months (interquartile range, 49.1 months) in the study group and 68.0 months (interquartile range, 41.8 months) in the control group ($P = .02$). There was no significant difference in active forward elevation preoperatively ($P = .330$) or postoperatively ($P = .852$) or external rotation preoperatively ($P = .835$) or postoperatively ($P = .274$) between the study and control groups (Tables 1 and 2). Furthermore, there was no significant difference in the preoperative-to-postoperative change in active forward elevation ($P = .311$) or external rotation ($P = .328$) between the 2 groups (Tables 1 and 2).

Table 1. Preoperative Range of Motion

	Cases	Controls	*P* Value
Preoperative active forward elevation,	97.5 (48.8, 150)	80.0 (40.0, 132)	.330
Preoperative active external rotation,	30.0 (20.0, 40.6)	37.5 (13.8, 45.0)	.835

NOTE. Data are presented as median (first quartile, third quartile).

Table 2. Postoperative ROM and Patient Outcomes

	Cases	Controls	*P* Value
Time from surgery to final ROM measurement postoperatively, mo	10.1 (4.6, 24.0)	12.0 (6.4, 29.0)	.481
Postoperative active forward elevation, °	140 (120, 150)	145 (126, 150)	.852
Postoperative active external rotation, °	30.0 (20.0, 40.0)	30.0 (20.0, 33.8)	.274
Postoperative ASES shoulder score	75.0 (58.3, 90.0)	76.7 (60.0, 91.7)	.651
Postoperative VAS score	1.00 (0.00, 4.00)	1.00 (0.00, 4.00)	.970
Postoperative SST score	66.7 (50.0, 83.3)	75.0 (58.3, 91.7)	.090
Postoperative SANE score	70.0 (41.0, 80.0)	77.0 (58.0, 90.0)	.081

NOTE. Data are presented as median (first quartile, third quartile).
ASES, American Shoulder and Elbow Surgeons; ROM, range of motion; SANE, Single Assessment Numeric Evaluation; SST, Simple Shoulder Test; VAS, visual analog scale.

In the study group, 1 female patient (2.2%) sustained an acromial fracture 3 months after RTSA. In the control group, 2 patients sustained fractures: 1 female patient (2.2%) sustained a fracture to the spine of the scapula 1 month after RTSA, and 1 male patient (2.2%) sustained a nondisplaced acromial fracture 2 months after RTSA. However, the difference in the total rate of acromial and scapular spine fractures was not significant ($P = .557$). There were more overall complications in the study group (n = 6, 13.3%) compared with the control group (n = 4, 8.9%); however, this difference was not statistically significant ($P = .737$) (Table 3).

Discussion

Patients in both the study and control groups reported similar post-RTSA functional outcomes without a significant difference in the rate of postoperative complications. Our hypothesis was confirmed because a history of acromioplasty did not negatively impact RTSA outcomes and did not increase patients' risk of acromial fracture after RTSA in this study.

In this study, patients in the study group had a mean postoperative ASES score of 75.0 compared with a mean ASES score of 76.7 for patients in the control group. These results are consistent with findings in the previously reported literature on functional outcomes and ROM after RTSA.[9,10] Cabarcas et al.[9] performed a systematic review that showed a mean postoperative ASES score of 75.0 in patients undergoing RTSA for rotator cuff tear. Furthermore, Cabarcas et al. found that across 4 studies of RTSA for rotator cuff arthropathy, mean active elevation rose from 61° preoperatively to 132° postoperatively. In our study, the patients in the study and control groups showed superior results in terms of postoperative active forward elevation: 140° and 145°, respectively.

The rate of post-RTSA acromial fracture (2.2%) in both the study group and the control group was lower than the rates reported in the most recent literature (3.7%-10%).[5,11,12] However, the cited studies were able to evaluate larger populations of patients undergoing RTSA compared with our study.[11,12] Prior studies have evaluated patient factors and sequelae of operative techniques that predispose patients to acromial fractures after RTSA. In 2020, Lau and Large[13] reported that the most significant patient risk factor for acromial fracture is osteoporosis, with an odds ratio of 1.97. Preexisting acromial pathology is another patient factor that has been theorized to be a risk factor for acromial fracture after RTSA, but this has not been correlated in the literature.[11] Mahendraraj et al.[11] examined the role of pre-existing acromial pathology, including os acromiale and acromial fragmentation, in postoperative RTSA outcomes. Although their findings refuted the conceptual risk of postoperative acromial fracture among patients with pre-existing acromial pathology, the incidence of acromial pathology and fracture is not sufficient to draw definitive conclusions.[11] In terms of intraoperative factors, superior glenoid baseplate screw stress risers and deltoid over-tensioning have been proposed—but not confirmed—as etiologies of acromial stress fractures.[13] Our study did not evaluate patient and operative risk factors for acromial fracture. Future studies with larger populations affected by post-RTSA acromial fractures may be able to further define patient and intraoperative factors that may increase the risk of acromial fractures.

Limitations

There are numerous limitations to this study. First, it is a retrospective study and is therefore subject to the associated bias. With only 45 patients in each group, the trends in uncommon events such as post-RTSA

Table 3. Patient Complications After Reverse Total Shoulder Arthroplasty

	Cases (n = 45)	Controls (n = 45)	*P* Value
Any complications			.737
No	39 (86.7)	41 (91.1)	
Yes	6 (13.3)	4 (8.89)	
Fracture			.557
No	44 (97.8)	43 (95.6)	
Yes	1 (2.22)	2 (4.44)	
Reoperation			.645
No	42 (93.3)	43 (95.6)	
Yes	3 (6.67)	2 (4.44)	
Infection			>.999
No	44 (97.8)	44 (97.8)	
Yes	1 (2.22)	1 (2.22)	
Instability			>.999
No	44 (97.8)	44 (97.8)	
Yes	1 (2.22)	1 (2.22)	

NOTE. Data are presented number (percentage).

acromial fracture may not have been fully appreciated. Post hoc sample size calculation confirms that 1,202 subjects would be required in each group to show a difference between groups. Because of the retrospective nature of our study, we did not perform a power analysis. However, we did recruit as many patients as possible from our retrospective database who fit our inclusion and exclusion criteria. Furthermore, baseline pre-RTSA functional outcome scores (ASES, SST, SANE, and VAS scores) could not be attained. Access to both pre- and post-RTSA functional outcomes would allow us to explore if there were significant differences in the change in functional outcomes between groups. Additionally, we did not control for surgery-related factors such as prosthesis type. Finally, we relied on patient charts and plain radiographs to evaluate whether a post-RTSA fracture was present; however, Levy et al.[14] determined that plain radiographs are unreliable in evaluating acromial fractures. Computed tomography scans and bone scans are more reliable studies, particularly in asymptomatic patients; however, they are not routinely performed.[14]

Conclusions

After RTSA, patients who have undergone a prior acromioplasty have similar functional outcomes without a significant difference in the rate of post-operative complications compared with patients with no history of acromioplasty. Furthermore, previous acromioplasty does not increase the risk of acromial fracture after RTSA.

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