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Reverse shoulder arthroplasty for postcapsulorrhaphy arthropathy results in similar clinical outcomes compared to glenohumeral osteoarthritis

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Background: Reverse shoulder arthroplasty (rTSA) is a reliable treatment option for various indications, including glenohumeral osteoarthritis (GHOA) with an intact rotator cuff. Following either open or arthroscopic instability surgery, a certain portion of patients develop postcapsulorrhaphy arthropathy (PCA) and ultimately need shoulder replacement. While these patients often have an intact rotator cuff, alterations to the native soft tissue anatomy may compromise the success of anatomic total shoulder arthroplasty, leading some to consider rTSA. Limited literature currently exists evaluating the outcomes of rTSA as a treatment for PCA.

Methods: Patients undergoing rTSA for the treatment of GHOA or PCA were retrospectively propensity score–matched in a 2.2:1 ratio based on age, sex, and body mass index, as well as preoperative American Shoulder and Elbow Surgeons score, forward elevation, and external rotation. Preoperative clinical outcomes at a minimum 2 years consisted of the visual analog scale for pain, Single Assessment Numeric Evaluation score, and American Shoulder and Elbow Surgeons score, as well as active forward elevation, internal rotation, and external rotation. The PCA cohort was stratified into subcohorts based on capsulorrhaphy technique (open or arthroscopic), all of which were soft tissue procedures. Univariate analysis was performed to compare cohort and subcohort demographics, clinical outcomes, and glenoid erosion patterns using the Walch classification system.

Results: After matching, the GHOA and PCA cohorts consisted of 82 and 37 patients, respectively, with no significant differences in age (GHOA 68 ± 6 years vs. PCA 66 ± 6 years; $P = .082$) or follow-up duration (GHOA 29 ± 12 months vs. PCA 29 ± 11 months; $P = .493$). Both groups demonstrated significant improvement in all clinical outcome metrics. The arthroscopic and open PCA subcohorts consisted of 19 and 18 patients, respectively. No significant preoperative or postoperative clinical outcome differences were observed between any cohort and subcohort studied ($P > .05$). There was a significant difference in Walch

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classification distribution between the GHOA and PCA cohorts ($P = .014$), with the most likely cause being a difference in frequency of A1 (GHOA 25.9% vs. PCA 36.3%) and B3 (GHOA 24.7% vs. PCA 12.1%) glenoid wear patterns.
Conclusion: This study demonstrates that rTSA is a reliable and effective treatment option for patients with PCA. Furthermore, the surgical technique of the previous soft tissue instability procedure (arthroscopic vs. open) does not affect clinical outcomes after rTSA. Given the predictability of the outcomes associated with rTSA for PCA, consideration should be given for this as a treatment choice.
Level of evidence: Level III; Retrospective Cohort Comparison; Prognosis Study

Keywords: Shoulder instability; postcapsulorrhaphy arthropathy; reverse shoulder arthroplasty; glenohumeral osteoarthritis; glenoid erosion; capsulorrhaphy approach

The volume of shoulder arthroplasty, specifically reverse shoulder arthroplasty (rTSA), has increased dramatically over the past decade.[13,14,24,33] As rTSA volume increases, indications for rTSA have expanded beyond deficiencies of the rotator cuff and rotator cuff arthropathy.[15,31] Current indications include trauma, oncologic reconstruction, and various degenerative conditions of the shoulder including glenohumeral osteoarthritis (GHOA) and postcapsulorrhaphy arthropathy (PCA).[11,20,28] As indications for rTSA broaden, the volume of outcome literature has increased, but have largely overlooked PCA.

PCA of the glenohumeral joint is known to be a potential late sequela of both anterior shoulder instability and the stabilization procedures used to treat it.[16,17,21,23,25,27,36,40] In one multicenter study, 26% of patients who previously underwent instability surgery developed arthropathy.[17] Prior studies have also compared anatomic total shoulder arthroplasty (aTSA) and rTSA for PCA.[1,2,9,22,39] While Cuff et al found both aTSA and rTSA to have comparable improvements in outcome scores for PCA, there was a higher complication and revision rate in the aTSA cohort compared to rTSA, mostly secondary to subscapularis failure. This complication has caused some to consider rTSA as a treatment for PCA.

The literature pertaining to glenoid erosion patterns has exploded since the classification system developed by Walch et al to describe glenoid morphology in cases of primary GHOA.[34] Modifications and specifications have been made over the years but the foundational literature of glenoid morphology has remained largely consistent.[3,30,35] Although the classification system was initially developed for GHOA, the glenoid erosion patterns provide a framework for comparing GHOA to PCA as both pathologies feature an intact cuff and an anterior-to-posterior wear development. Prior studies have demonstrated that rTSA for GHOA results in superior outcomes compared to other indications.[32] The primary aim of this study was to determine whether rTSA for the treatment of PCA results in comparable clinical outcomes to rTSA for GHOA by analyzing patient-reported outcome measures (PROMs), range of motion (ROM), and complication rates in a propensity score–matched cohort. The secondary aim was to assess the impact of previous instability procedure type (open vs. arthroscopic) on rTSA outcomes and to characterize glenoid erosion patterns in PCA compared to GHOA patients.

Materials and methods

Patient selection

A retrospective analysis of prospectively collected data was performed following approval from the institutional review board to conduct this study. Patients were identified and selected using a prospectively maintained institutional database with more than 75% overall clinical follow-up at 2 years (Outcomes Based Electronic Research Database; Columbia, MO, USA). Patients were included if they had undergone primary rTSA between 2015 and 2021 for the treatment of GHOA with an intact rotator cuff or for the treatment of PCA, had a minimum clinical follow-up of 2 years, complete preoperative and postoperative functional outcomes scores, and accessible preoperative computed tomography (CT) imaging to assess glenoid morphology according to the modified Walch classification system.[3] While the Walch classification is used to classify glenoid erosion patterns in primary GHOA, we also applied this framework to the PCA patients to evaluate whether differences in glenoid erosion pattern existed between these 2 groups. PCA patients were included if their initial surgery involved a soft tissue capsulorrhaphy for anterior instability, whereas those who underwent bony capsulorrhaphy (Latarjet, Bristow) were excluded. Excluding these patients ensures a more homogeneous study population and allows for a more accurate assessment of rTSA outcomes in PCA without the added complexity of altered glenoid morphology from bony procedures. While selection criteria for the PCA cohort were limited to soft tissue capsulorrhaphy procedures, the specific type of procedure was unverifiable as the operative reports from the previous instability procedures were unavailable. While there is inevitable variability when comparing the downstream effects of prior surgeries, the unifying factor of these patients is their development of PCA to indicate a treatment of an rTSA, which provides a substantial foundation for clinical outcome comparison. Additionally, PCA patients were further categorized based on whether the initial instability procedure was performed via an open or arthroscopic approach. Patients were excluded from the study if there was an rTSA performed for reasons other than PCA or primary GHOA, a documented rotator cuff tear preoperatively or intraoperatively, or an incomplete clinical follow-up. All surgeries were performed by a single high-volume fellowship-trained shoulder and elbow surgeon (A.J.).

Matching

Patients meeting the aforementioned criteria were then retrospectively propensity score–matched ratio based on the following covariates: age, sex, body mass index (BMI), preoperative American Shoulder and Elbow Surgeons (ASES) score, preoperative forward elevation (FE), and preoperative external rotation (ER). The method used for propensity score matching was a greedy nearest neighbor matching algorithm without replacement.[8] This process involved pairing each treated subject with the control subject whose propensity score was closest, based on a predetermined caliper width of 0.5 times the standard deviation (SD) of the logit of the propensity scores among the entire population. The greedy nearest neighbor algorithm ensures that each treated subject is paired with the closest control subject (in terms of the propensity score), one by one, without reusing control subjects (ie, matching is done without replacement). To reduce the risk of making poor or substandard matches, a caliper was applied. The caliper defines the maximum allowable difference in propensity scores between the treated and control subjects. This approach helps ensure that the treated and control subjects being compared are sufficiently similar, improving the reliability of the results and minimizing bias due to poor matching. Furthermore, it has been shown that precision increases as caliper width decreases, with 0.2 to 0.5 times the SD of the logit of the propensity score having been experimentally demonstrated as an appropriate range for the effective control of variance within a given sample set.[8]

Surgical technique

The senior surgeon (A.J.) performed all rTSAs. Patients were placed under general anesthesia in a beach chair position. All patients were administered an interscalene block preoperatively, and a deltopectoral approach was used in all cases. Additionally, intraoperative visual assessment was performed in all cases to confirm the integrity of the rotator cuff during the procedure. When intact, the biceps tendon was tenodesed to the pectoralis major tendon. In all cases, the subscapularis was peeled and repaired using combination of simple and Mason-Allen transosseous sutures. All patients were provided the same prosthetic implant (AltiVate Reverse; DJO Surgical, Austin, TX, USA). Female patients received a 32 minus 4-mm lateralized glenosphere, while male patients received a 36-mm neutral lateralized glenosphere, as per the senior author's preference. An uncemented inlay standard length humeral component was implanted in all patients, and glenoid bone grafting was not performed in any patient. All patients received similar postoperative rehabilitation instructions: restricted shoulder ROM in a simple sling without an abduction pillow for the first 6 weeks in combination with progressive ROM and strengthening using a physician-directed home therapy protocol beginning at 2 weeks postoperatively.

Clinical outcome assessment

Patient demographic data, such as age, sex, and BMI, were retrieved from the electronic medical record. Clinical examination was conducted by the senior author at both the patients' preoperative visit closest to the date of surgery and at the most recent postoperative visit. Active shoulder ROM was assessed via evaluation of FE, ER, and internal rotation (IR). FE and ER with the arm at the side were assessed using a goniometer. IR was measured by the highest vertebral level of the spine that the patient could reach with their thumb. Levels of IR were classified using a point system described by Triplet et al: 0 for the buttocks/hip, 1 for the sacrum, 2 for L5, 3 for L4, and so on, adding an additional point for each vertebra reached. PROMs, including the ASES score, Single Assessment Numeric Evaluation (SANE) score, and visual analog scale (VAS) for pain, were prospectively collected at preoperative appointments and at the most recent follow-up. Complications and the need for revision surgery were prospectively recorded.

Radiographic evaluation

Patients in the final cohort had preoperative true anteroposterior and axillary radiographs and CT imaging available for review. All patients also had radiographs obtained at their last clinical follow-up at a minimum of 2 years. Preoperative CT imaging was used to confirm a primary diagnosis of either PCA or GHOA with an intact rotator cuff as well as to classify preoperative glenoid morphology according to the modified Walch classification system.[3] Walch classifications were assigned through consensus by 2 fellowship-trained shoulder and elbow surgeons (J.M.K. and A.J.).

Statistical analysis

Descriptive statistics were performed for each cohort separately and expressed as mean and SD, median and interquartile range, or number and percentage of group when appropriate based on data type and distribution. Univariate analysis was performed to compare baseline demographics, comorbidities, and clinical outcomes between cohorts as well as between preoperative to postoperative timepoints, using *t*-test, Mann-Whitney U test, Chi-squared test, and Fisher's exact test, as indicated by the data type and distribution. Improvements in ASES were assessed using the minimal clinically important difference (MCID) (10.4) and substantial clinical benefit (SCB) (28.3) thresholds, as calculated by Puzzitiello et al.[26] All statistical analyses used an alpha-risk level of 0.05 to estimate significance. All statistical analyses were performed using R statistical software (version 4.2.2; R Foundation for Statistical Computing).

Results

Patient demographics

The final matched cohort included 119 patients with 82 and 37 patients in the GHOA and PCA cohort, respectively, resulting in a 2.2:1 ratio. The mean follow-up in the GHOA

Table I Comparing baseline characteristics and demographics of the PCA and GHOA cohorts

Parameter	PCA	GHOA	*P* value
	n = 37	n = 82	
Age*	65.7 ± 6.0	67.7 ± 6.4	.082
Sex*			
Male	27 (73.0%)	53 (64.6%)	
Female	10 (27.0%)	29 (35.4%)	.493
BMI*	30.5 ± 6.8	30.3 ± 5.9	.923
Follow-up (mo)	28.6 ± 10.6	29.3 ± 11.5	.72
Walch classification†	n = 33	n = 81	
A1	12 (36.3%)	21 (25.9%)	**.014**‡
A2	4 (12.1%)	8 (9.8%)	
B1	2 (6.0%)	3 (3.7%)	
B2	9 (27.3%)	25 (30.8%)	
B3	4 (12.1%)	20 (24.7%)	
C	0 (0%)	3 (3.7%)	
D	2 (6.0%)	1 (1.2%)	
ASA comorbidity score > 2, *n* = ...	8 (21.6%)	16 (19.5%)	.721
Comorbidities			
Hypertension	21 (56.8%)	56 (68.3%)	.763
Hypercholesterolemia	17 (45.9%)	28 (34.1%)	.306
Diabetes mellitus	2 (5.4%)	11 (13.4%)	.22
Depression	11 (29.7%)	21 (25.6%)	.806
Thyroid disease	5 (13.5%)	11 (13.5%)	> .999
Obesity	17 (45.9%)	41 (50.0%)	.697
Current smoker	1 (2.7%)	1 (1.2%)	.931
Preoperative narcotic use	3 (8.1%)	6 (7.3%)	> .999
Complications	0 (0%)	1 (1.2%)	> .999
Capsulorrhaphy approach§			
Open	19 (51.3%)		
Arthroscopic	18 (48.6%)		

PCA, postcapsulorrhaphy arthropathy; *GHOA*, glenohumeral osteoarthritis; *BMI*, body mass index; *ASA*, American Society of Anesthesiologists.
n (%) represents count and frequency; x ± s represents mean and standard deviation.
* Variables used to propensity score–matched PCA and GHOA patients, in addition to preoperative American Shoulder and Elbow Surgeons score, forward elevation, and external rotation.
† Only applicable to GHOA cohort.
‡ Statistical significance with alpha risk of 0.05.
§ Only applicable to PCA cohort.

group was 28.6 ± 10.6 months, compared with 29.3 ± 11.5 months in the PCA group (P = .720). There were no significant differences in age (GHOA 68 ± 6 years vs. PCA 66 ± 6 years; P = .082), sex (GHOA 73% male vs. PCA 64% male, P = .493), or BMI (GHOA 30.5 ± 6.8 vs. PCA 30.3 ± 5.9, P = .923). There were no significant differences in comorbidities between the 2 cohorts as both groups had a similar percentage of those with an American Society of Anesthesiologists score greater than 2 (GHOA 21.6% >2 vs. PCA 19.5% >2, P = .721). Within the PCA cohort, 19 of the 37 patients (51.3%) had previously undergone an open capsulorrhaphy approach, while the remaining 18 patients (48.6%) had undergone a prior arthroscopic procedure. There was a significant difference in preoperative Walch classification distribution between the GHOA and PCA cohorts (P = .014). The most likely cause for the difference was the frequency of A1 (GHOA 25.9% vs. PCA 36.3%) and B3 (GHOA 24.7% vs. PCA 12.1%) glenoid wear patterns (Table I).

Clinical outcomes

No significant differences were found between cohorts in terms of baseline or final VAS scores (P = .153 and P = .404, respectively), ASES scores (P = .717 and P = .463, respectively), or SANE scores (P = .481 and P = .798, respectively). In addition, baseline-to-postoperative changes in PROMs did not significantly differ between groups (VAS, P = .527; ASES, P = .834; SANE, P = .620) (Table II). The MCID for ASES was achieved by 36 patients (97.2%) in the PCA cohort and 80 patients (97.5%) in the GHOA cohort (P > .999). The SCB for ASES was achieved by 32 patients (86.4%) in the PCA cohort and by 72 patients (87.8%) in the GHOA cohort (P > .999).

Table II Comparing clinical outcome of the PCA and GHOA cohorts

Parameter	PCA	GHOA	*P* value
	n = 37	n = 82	
ASES			
Preoperative*	38.4 ± 17.3	37.2 ± 17.7	.717
Postoperative	88.7 ± 12.4	86.6 ± 17.5	.463
Change	50.2 ± 19.3	49.0 ± 20.0	.834
% reached MCID	36 (97.2%)	80 (97.5%)	> .999
% reached SCB	32 (86.4%)	72 (87.8%)	> .999
Pain			
Preoperative	4.9 (4.0, 7.0)	6.0 (4.6, 8.0)	.153
Postoperative	0 (0, .690)	0 (0, 1.00)	.404
Change	−4.9 (−6.4, 3.8)	−5.2 (−7.0, 3.9)	.527
SANE			
Preoperative	35.4 ± 28.8	31.6 ± 22.9	.481
Postoperative	87.7 ± 14.1	86.84 ± 20.1	.798
Change	52.3 ± 30.4	55.3 ± 29.8	.62
FE			
Preoperative*	101.9 ± 25.9	103.8 ± 24.4	.700
Postoperative	141.6 ± 16.3	142.6 ± 14.6	.767
Change	39.7 ± 25.2	38.7 ± 25.3	.838
ER			
Preoperative*	26.4 ± 17.6	28.0 ± 15.9	.63
Postoperative	51.0 ± 17.9	53.5 ± 19.0	.475
Change	24.6 ± 20.4	25.6 ± 18.8	.810
IR			
Preoperative	3.68 ± 1.45	3.44 ± 1.15	.385
Postoperative	5.19 ± 1.52	5.00 ± 1.76	.552
Change	1.51 ± 1.52	1.56 ± 1.60	.877

PCA, postcapsulorrhaphy arthropathy; *GHOA*, glenohumeral osteoarthritis; *ASES*, American Shoulder and Elbow Surgeons; *MCID*, minimal clinically important difference; *SCB*, substantial clinical benefit; *SANE*, Single Assessment Numeric Evaluation; *FE*, forward elevation; *ER*, external rotation; *IR*, internal rotation.

n (%) represents count and frequency; x ± s represents mean and standard deviation, Q1, M, Q3 represents 1st quartile, median, and 3rd quartile.

* Variables used to propensity score–matched PCA and GHOA patients, in addition to age, body mass index, and sex.

Baseline active ROM was similar between both PCA and GHOA cohorts in all planes measured. Both cohorts experienced baseline-to-postoperative improvements in all planes of motion. Postoperative FE (141.6° ± 16.3 vs. 142.6° ± 14.6; *P* = .767), active ER (51.0° ± 17.9 vs. 53.5° ± 19.0; *P* = .475), and IR (5.2 ± 1.5 levels vs. 5.0 ± 1.8 levels; *P* = .552) did not significantly differ between the 2 groups, nor did the baseline-to-postoperative improvement in both (FE, *P* = .838; ER, *P* = .810; IR, *P* = .877) (Table II).

Clinical outcomes subcomparison

When comparing the PCA subcohorts of open vs. arthroscopic, no significant differences were found between cohorts in terms of baseline or final VAS scores (*P* = .456 and *P* = .889, respectively), ASES scores (*P* = .431 and *P* = .383, respectively), or SANE scores (*P* = .606 and *P* = .185, respectively). Additionally, baseline-to-postoperative changes in PROMs did not significantly differ between groups (VAS, *P* = .513; ASES, *P* = .881; SANE, *P* = .908). The MCID for ASES was achieved by 19 patients (100%) in the arthroscopic cohort and 17 patients (94.6%) in the open cohort (*P* > .999). The SCB for ASES was achieved by 17 patients (89.5%) in the arthroscopic cohort and by 15 patients (83.3%) in the open cohort (*P* > .999).

Baseline active ROM was similar between both arthroscopic and open cohorts in all planes measured. Both cohorts experienced baseline-to-postoperative improvements in all planes of motion. Postoperative FE (144.7° ± 11.9 vs. 138.7° ± 19.4; *P* = .260), active ER (47.2° ± 16.7 vs. 54.5° ± 18.7; *P* = .221), and IR (5.0 ± 1.7 levels vs. 5.4 ± 1.3 levels; *P* = .474) did not significantly differ between the 2 groups, nor did the baseline-to-postoperative improvement in both (FE, *P* = .271; ER, *P* = .785; IR, *P* = .308) (Table III).

There was one reported complication in the GHOA cohort (1.2%), a traumatic, nondisplaced fracture of the acromion, while there were none in the PCA cohort (*P* > .999).

Table III Comparing clinical outcomes of open vs. arthroscopic capsulorrhaphy approaches

Parameter	Arthroscopic	Open	*P* value
	n = 19	n = 18	
ASES			
Preoperative	40.7 ± 18.0	36.2 ± 16.7	.431
Postoperative	90.5 ± 10.2	87.0 ± 14.1	.383
Change	49.8 ± 19.1	50.8 ± 19.9	.881
% reached MCID	19 (100%)	17 (94.6%)	.466
% reached SCB	17 (89.5%)	15 (83.3%)	.835
Pain			
Preoperative	5.0 (4.0, 6.0)	5.0 (4.2, 7.6)	.456
Postoperative	0 (0, 0)	0 (0, 1)	.889
Change	−5.0 (−5.8, 4.0)	−5.0 (−6.6, 3.4)	.513
SANE			
Preoperative	37.9 ± 29.5	33.0 ± 28.7	.606
Postoperative	90.8 ± 12.8	84.7 ± 14.9	.185
Change	52.9 ± 28.1	51.7 ± 33.2	.908
FE			
Preoperative*	100.3 ± 21.3	103.4 ± 30.2	.715
Postoperative	144.7 ± 11.9	138.7 ± 19.4	.26
Change	44.4 ± 23.2	35.3 ± 26.7	.271
ER			
Preoperative*	23.6 ± 16.6	29.0 ± 18.5	.362
Postoperative	47.2 ± 16.7	54.5 ± 18.7	.221
Change	23.6 ± 26.3	25.5 ± 13.5	.785
IR			
Preoperative	3.2 ± 1.4	4.1 ± 1.4	.064
Postoperative	5.0 ± 1.7	5.4 ± 1.3	.474
Change	1.8 ± 1.4	1.3 ± 1.6	.308

ASES, American Shoulder and Elbow Surgeons; *MCID*, minimal clinically important difference; *SCB*, substantial clinical benefit; *SANE*, Single Assessment Numeric Evaluation; *FE*, forward elevation; *ER*, external rotation; *IR*, internal rotation.

n (%) represents count and frequency; x ± s represents mean and standard deviation; Q1, M, Q3 represents 1st quartile, median, and 3rd quartile.

* Variables used to propensity score–matched PCA and GHOA patients, in addition to age and body mass index.

Discussion

The findings of this study demonstrate comparable clinical outcomes in patients undergoing rTSA for PCA compared to GHOA. Furthermore, similar improvement was found across all outcome metrics within the PCA subcohorts comparing prior open vs. arthroscopic capsulorrhaphy techniques. Regarding glenoid erosion patterns, the PCA cohort had higher rates of concentric glenoid wear patterns, whereas the GHOA group had more eccentric glenoid wear patterns. Previous studies have demonstrated superior outcomes with rTSA for GHOA compared to other indications, and given this, the comparable outcomes demonstrated in this study with rTSA for PCA should encourage surgeons to consider this as a viable and reliable treatment strategy. To our knowledge, this study is the first to systematically compare rTSA outcomes for these 2 indications.

Current literature recognizes GHOA as a common indication for rTSA.[32] With the growing utility and success of rTSA surgery, indications for rTSA have simultaneously expanded.[6,7,29,32] Other common indications for rTSA include rotator cuff tear arthropathy (CTA), massive irreparable rotator cuff tears, proximal humerus fractures (PHFs), post-traumatic arthritis, rheumatoid arthritis, and failed total shoulder arthroplasty.[4,19,32] Literature suggests that the indication and primary diagnoses for rTSA may result in clinically important outcomes, and thus, may provide crucial information for treatment planning and patient expectations.[26] Therefore, it is essential to consider what influence other indications for rTSA might have on patient outcomes. PCA is one of the indications for rTSA for which there is a lack of literature reporting influence on patient outcomes.

PCA is a long-term complication that can occur as a result of anterior shoulder instability and the corrective procedures used to address this pathology.[16,17,21,23,25,27,36,40] There are several approaches to corrective surgeries for shoulder instability that include both open and arthroscopic techniques. However, these procedures can result in alterations to the soft tissue structures of the shoulder (rotator cuff and capsule), mechanics of the glenohumeral joint, and excessive stiffness due to loss of ER and maximum elevation of the arm.[5,18,37] In the long term, PCA can develop. Our study demonstrated that patients undergoing rTSA for PCA, regardless of prior open or arthroscopic technique, experience similar postoperative outcome metrics including ASES and SANE scores as well as ROM compared to those with a primary diagnosis of GHOA.

There have been several other attempts to classify outcomes of rTSA based on primary diagnoses and indications. Testa et al demonstrated that patients who underwent rTSA for GHOA with intact rotator cuffs had superior outcomes when compared to patients with rotator CTA or massive irreparable rotator cuff tears without arthritis who underwent rTSA. This study asserts that primary indication for rTSA can influence patient outcomes, and several other studies corroborate this notion.[32] Waterman et al compared short-term and mid-term outcomes of patients who underwent rTSA for GHOA with intact rotator cuffs to a matched rotator cuff arthropathy cohort and found that each primary diagnosis cohort had similar improvement in outcomes. Outcomes of PHFs were compared against those undergoing elective rTSA for GHOA, CTA, and rheumatoid arthritis and found that rate of revision-free implant survival at 10 years was 97.3% for PHFs compared with 96.1% for GHOA. Oxford Shoulder Scores were compared between groups and at 5 and 10 years found no significant difference in functional outcomes between PHFs and the elective indications.[38] Ekelund et al investigated rheumatoid arthritis for rTSA and found significantly improved pain levels as well as a low incidence of complications.[12] Additionally, De la Selle et al retrospectively evaluated patients for outcomes of rTSA based on indication and found no significant differences in outcomes in terms of ASES or Constant score for patients with massive rotator cuff tears or CTA as indications.[10] Furthermore, Saini et al discuss their findings GHOA with intact rotator cuffs had improved functional and clinical outcomes when compared with patients who underwent rTSA for CTA.[29]

As indications for rTSA continue to grow, further investigations into functional outcomes associated with various primary diagnoses are essential to optimize patient care and treatment planning. In addition to indications, specific parameters for evaluating treatment success from rTSA, such as glenoid wear pattern, are important to investigate. While originally designed for GHOA but not for PCA, the glenoid erosion patterns in the Walch classification system offer a useful framework for comparing GHOA and PCA, as both involve intact cuffs and similar wear patterns. Cuff et al reported 15% and 5% of A1 and B3 wear patterns, respectively, in their rTSA for PCA cohort. These values are lower than our study's findings (36.3% and 12.1%), but again, it should be noted their rTSA cohort is approximately half the size as this study's. Our findings indicate that PCA patients tend to have more concentric wear patterns than those with GHOA, suggesting that PCA may lead to increased concentric wear. Contrary to our hypothesis, which predicted more posterior wear due to prior capsulorrhaphy tightening, the results showed the opposite. It is surprising that PCA was not associated with higher rates of posterior wear. This finding may suggest that we may not be pushing the humeral head out the back as much as previously thought during capsulorrhaphy procedures, particularly in shoulders predisposed to anterior subluxation or instability. This discrepancy, coupled with the limited existing literature, underscores the need for further research.

The present study has several limitations. The first is the study's retrospective design. A prospective design with a larger volume of patients in each cohort would limit bias and increase statistical power. Furthermore, the 2 cohorts in this study are not the same sample size, which may have skewed findings such as the preoperative glenoid wear pattern that was deemed significantly different based on our findings. Next, while single-surgeon studies have inherent limitations, they also offer advantages such as eliminating intersurgeon variability in surgical techniques, decision-making, and postoperative rehabilitation protocols. However, given that the data reflect a single surgeon's experience, the results may not be generalizable to broader populations with varying surgical approaches and expertise. Additionally, the PCA patients also had their previous stability procedures performed by different surgeons at different institutions and at different time points, using a variety of techniques, all of which may have impacted their preoperative baseline outcome scores and ROM. The variability in previous surgical interventions adds heterogeneity to the PCA cohort, potentially influencing the results in ways that cannot be fully accounted for. Another limitation is that we did not use an adjusted *P* value to correct for multiple comparisons, as is done with the Bonferroni correction method. However, given that our study is retrospective without a-priori defined analyses and is purely exploratory rather than confirmatory for final decision-making, we felt that it was not necessary to perform such corrections. Doing so can increase the chance for type 2 errors and be diminutive to the power of an analysis. Nonetheless, it remains possible that some of our significant results may be due to chance, and this exploratory work should serve as a pilot for future studies. Moreover, while selection criteria for the PCA cohort were limited to soft tissue capsulorrhaphy procedures, the specific type of procedure could not be confirmed as the operative reports from the previous instability procedures were unavailable. Given the lack of previous operative report availability, we were not able to comment on the interval between the initial capsulorrhaphy procedure and subsequent rTSA, which may influence the degree of soft tissue changes and clinical outcomes. While there is inevitable variability when comparing the downstream effects of prior surgeries, the unifying factor of these patients is their development of PCA to indicate a treatment of an rTSA, which provides a substantial foundation for clinical outcome comparison.

Finally, it should be noted that complications like instability are rare and the sample size of this study may be underpowered to identify rare complications that differ between the groups. It should also be noted that collecting a large sample of patients who have developed PCA and then went on to receive a reverse arthroplasty is difficult as this is not very common. Therefore, the comparison of rare complications was not a primary goal of this study and should be explored further in future studies with a sufficient sample size. Future studies could address these limitations by employing multicenter collaborations to capture a more diverse patient population and standardizing baseline assessments to control for variability in prior procedures and surgeon experience. Implementing prospective methodologies and larger cohort analyses could further enhance the robustness of findings related to rTSA outcomes for PCA patients.

Conclusion

Patients treated with rTSA for PCA have excellent clinical outcomes, which were comparable to a matched cohort of patients undergoing rTSA for GHOA. Furthermore, the surgical technique of the prior soft tissue stabilization procedure did not affect clinical outcomes after undergoing rTSA. Previous capsulorrhaphy may lead to slightly more concentric glenoid wear patterns compared to patterns seen in GHOA patients; however, studies with larger cohorts, dedicated to assessing PCA glenoid wear, are needed to accurately assess differences in glenoid morphology. While an individualized approach should always be considered when determining the most appropriate type of arthroplasty for patients with PCA, rTSA appears to be a safe and reliable treatment option for these patients.

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