Anatomic and Reverse Shoulder Arthroplasty for Management of B2 and B3 Glenoid Morphology: A Matched Cohort Analysis

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INTRODUCTION: Posterior glenoid bone loss is commonly encountered in advanced glenohumeral osteoarthritis (GHOA). Both anatomic total shoulder arthroplasty (TSA) and reverse shoulder arthroplasty (RSA) are viable options in patients with Walch B2 and B3 glenoid morphology. Limited evidence exists comparing RSA and TSA in this setting. The purpose of this retrospective cohort study was to compare the clinical and radiographic outcomes of patients with B2 and B3 glenoids undergoing TSA or RSA.

METHODS:

A retrospective cohort study was performed on patients with GHOA treated with primary shoulder arthroplasty by two surgeons at two separate hospitals and with a minimum of 2-year clinical follow up. Preoperative computed tomography was used to determine B2 and B3 glenoid morphology as described by the modified Walch classification. Preoperative planning software was utilized to determine glenoid retroversion and humeral subluxation. All TSAs were performed using a standard non-augmented all polyethylene glenoid component and all RSAs were performed with a standard monoblock screw in baseplate. Patients were categorized based on TSA or RSA and matched 1:1 by gender, glenoid morphology, and age. Patient-reported outcome measures (PROMs), active range of motion (ROM), the presence and severity of glenoid loosening from most recent radiographs, and complications were compared. The percentage of patients that reached previously established clinically significant thresholds for minimal clinically important difference (MCID) and substantial clinical benefit (SCB) was also comparatively assessed.

RESULTS: A total of 202 patients with GHOA and B2 or B3 glenoid were included in the 1:1 matched analysis (101 each group). The cohorts were well-matched with no differences in gender, age, ASA, BMI, and preoperative glenoid morphology ($p > 0.05$). No differences were found in mean glenoid retroversion and humeral subluxation comparing B2 and B3 glenoids treated with either TSA or RSA ($p > 0.05$) (Table 1). There were no significant differences in any preoperative PROM or ROM measurement between the groups, except for greater internal rotation in TSA patients ($p<0.001$). Patients undergoing RSA demonstrated significantly greater postoperative ASES ($p=0.02$), VAS pain scores ($p=0.004$), and greater preoperative to postoperative improvement in SANE ($p=0.04$). Postoperative ROM was similar between TSA and RSA patients in forward elevation ($p=0.459$) and external rotation ($p=0.920$), however, TSA demonstrated significantly better internal rotation ($p < 0.001$) (Table 2). Most patients in both groups (TSA 96.0%; RSA 99%) reached the ASES MCID threshold ($p =0.248$), and 82% of TSA patients and 90% of RSA patients reached SCB threshold ($p=0.113$). Glenoid radiolucency was present in 29% of TSA cases with 3 patients with gross glenoid loosening. There were 2 patients (2%) who underwent RSA who had evidence of baseplate loosening.

DISCUSSION AND CONCLUSION: Primary RSA yields comparable to superior outcomes to TSA in patients with GHOA and with B2 or B3 glenoid morphology. Both TSA and RSA provide substantial clinical benefits to patients with significant posterior glenoid wear.

Table 1: Demographic data of patients with preoperative Walch B2, B3 glenoid matched 1:1 by gender, Walch classification, and age

	Anatomic TSA (n=101)	RSA (n=101)	p-value
Mean age (+/-), yr	71 ± 6.3	72 ± 6.0	0.270
Mean follow-up (range), mo	47 (24-122)	31 (24-85)	**<0.001***
Sex distribution, n (%)			1.000
Male	54 (53)	54 (53)	
Female	47 (47)	47 (47)	
Glenoid Wear - Walch Classification, n (%)			1.000
B2	70 (69)	70 (69)	
B3	31 (31)	31 (31)	
B2 Glenoid Version, degrees (n)	-17.6 ± 6.2 (40)	-19.0 ± 9.6 (57)	0.462
B2 Subluxation, %	72 ± 11	76 ± 11	0.067
B3 Glenoid Version, degrees (n)	-19.0 ± 5.8 (14)	-25.1 ± 10.9 (18)	0.102
B3 Subluxation, %	67 ± 10	74 ± 15	0.176
ASA Comorbidity Score* (+/-)	2.3 ± 0.6	2.2 ± 0.4	0.067
Body Mass Index (+/-)	29.0 ± 5.3	29.8 ± 5.1	0.305

ASA, American Society of Anesthesiologists; TSA, total shoulder arthroplasty; RSA, reverse shoulder arthroplasty

** Denotes statistical significance at $p < 0.05$*

Table 2: Comparison of outcomes scores by type of shoulder arthroplasty

	Anatomic TSA	RSA	p-value
VAS Pain			
Preoperative	6.2 ± 2.5	6.0 ± 2.3	0.436
Postoperative	1.2 ± 2.5	0.5 ± 1.0	**0.004***
Change	-5.0 ± 3.2	-5.5 ± 2.4	0.184
SANE			
Preoperative	33.9 ± 20.0	30.6 ± 18.3	0.227
Postoperative	88.0 ± 18.1	91.6 ± 13.0	0.109
Change	54.1 ± 25.6	61.0 ± 22.1	**0.043***
ASES			
Preoperative	33.6 ± 17.3	34.8 ± 15.6	0.621
Postoperative	83.9 ± 21.4	89.8 ± 11.7	**0.016***
Change	50.3 ± 23.6	55.0 ± 18.9	0.114
Forward Flexion			
Preoperative	96.0 ± 27.4	94.0 ± 22.1	0.552
Postoperative	142.5 ± 17.9	140.7 ± 16.2	0.459
Change	46.4 ± 27.1	46.7 ± 23.9	0.932
External Rotation			
Preoperative	25.1 ± 15.1	22.5 ± 14.4	0.199
Postoperative	52.5 ± 16.8	52.2 ± 18.0	0.920
Change	27.3 ± 17.5	29.8 ± 20.1	0.362
Internal Rotation$^{\phi}$			
Preoperative	3.9 ± 2.5	2.7 ± 1.4	**<0.001***
Postoperative	6.5 ± 2.1	5.2 ± 2.0	**<0.001***
Change	2.6 ± 2.7	2.5 ± 2.1	0.727

ASES, American Shoulder and Elbow Surgeons Shoulder Assessment; SANE, Single Assessment Numeric Evaluation; VAS, visual analog scale

** Denotes statistical significance at $p < 0.05$*

ϕ Level of internal rotation converted to numeric scale as previously described: buttock/greater trochanter (2 points); sacrum-L4 (4 points); L3-L1 (6 points); T12-T8 (8 points); T7-T1 (10 points).