

# Revision-free Reverse Shoulder Arthroplasty Patients Report Greater ADL Difficulty Compared to Anatomic Total Shoulder Arthroplasty Patients at Mid-Term Follow-up

Brian O Molokwu, Brian O Molokwu, Jacquelyn Xu, Steven Gonzales Farrell, Arthur J Perry, Christopher Roche, Mandeep Virk, Joseph D Zuckerman, Jie Jonathan Yao

## INTRODUCTION:

Patient-reported outcome measures (PROMs) are commonly used to assess success after shoulder arthroplasty, yet many fail to capture common activities of daily living (ADLs). As indications for reverse shoulder arthroplasty (RSA) expand, it is unclear whether there are significant differences in RSA patients' ADLs compared to those undergoing anatomic total shoulder arthroplasty (aTSA). Current comparative data is focused on survivorship rather than differences in functional level in a surviving arthroplasty. Therefore, the purpose of this study was to compare limitations in ADLs between patients with revision-free aTSA and RSA at mid-term follow-up.

## METHODS:

This single-center retrospective cohort study included 253 patients (177 aTSA, 76 RSA) who underwent primary aTSA or RSA using a single system (\*\*\*; \*\*\*, Gainesville, FL). Minimum follow-up was 7 years (mean 124 ± 26 months; range 90 - 216 months; Table 1). Patients were excluded if they underwent revision, as the focus of this study was the differences in ADL function rather than survivorship. ADLs assessed included sleeping comfortably, tucking in a shirt behind the back, washing the back or fastening a bra, putting on a coat, performing personal hygiene or toilet needs, washing or combing hair, removing an object from the back pocket, and putting on a button-up shirt or an undershirt/sweater. Univariate analysis was first performed to compare characteristics between aTSA and RSA patients. Logistic regression, adjusting for age at surgery, sex, preoperative range of motion, and presence of preoperative rotator cuff pathology, was used to assess the odds of RSA patients reporting better ADL function compared to aTSA patients.

## RESULTS:

Postoperatively, the aTSA group demonstrated superior outcomes in all planes of motion (except active abduction) and patient-reported outcome scores (Table 1). A greater proportion of aTSA patients reported normal ADLs postoperatively compared to RSA patients (Table 2). On multivariate analysis, RSA patients had lower ADL function in several key areas, including personal hygiene and toilet needs (OR 0.22 [95% CI: 0.08–0.64]; p = 0.005), washing or combing hair (OR 0.35 [0.14–0.94]; p = 0.033), putting on a button-up shirt (OR 0.08 [0.02–0.24]; p < 0.001), and putting on pants (OR 0.11 [0.04–0.35]; p < 0.001; Table 3).

## DISCUSSION AND CONCLUSION:

At an average of 10 years postoperatively, aTSA patients achieved a superior range of motion than RSA patients. For specific ADL tasks such as personal hygiene and toilet needs, washing or combing hair, putting on a button-up shirt, and putting on pants, RSA patients reported greater difficulty, even when controlling for preoperative factors.

Table 1: Characteristics and outcomes of revision-free aTSA and RSA patients.

Variable	Total (n=253)	aTSA (n=177)	RSA (n=76)	p-value*
<b>Patient Demographics</b>				
Age at Surgery (years)	68 ± 9	62 ± 9	69 ± 8	<0.001
BMI (kg/m <sup>2</sup> )	30.9 ± 7.2	31.0 ± 7.3	30.5 ± 7.2	0.625
Follow-up (months)	124 ± 24	124 ± 24	123 ± 20	0.764
Female sex	54% (125)	47% (125)	73% (54)	<0.001
Surgery on Dominant Arm	57% (144)	57% (144)	66% (50)	0.084
Revised Shoulder Implant	61% (153)	65% (113)	57% (40)	0.126
Post-operative shoulder surgery	23% (58)	23% (40)	40% (30)	0.010
Current Rotator Cuff	27% (69)	37% (67)	37% (4)	<0.001
<b>Comorbidities</b>				
Hypertension	31% (78)	40% (69)	37% (43)	0.207
Heart Disease	19% (48)	27% (52)	12% (9)	0.276
Diabetes	14% (36)	14% (24)	14% (11)	0.730
Stroke	12% (30)	11% (20)	13% (11)	0.619
<b>Preoperative Outcomes</b>				
Active Abduction (°)	77 ± 29	84 ± 24	59 ± 33	<0.001
Active Forward Extension (°)	89 ± 33	94 ± 28	73 ± 40	<0.001
Internal Rotation score	3 ± 2	3 ± 1	3 ± 2	0.320
Active External Rotation (°)	17 ± 14	16 ± 12	21 ± 19	0.010
SET score	3 ± 2	3 ± 2	2 ± 2	0.804
Constant score	31 ± 10	34 ± 10	26 ± 9	<0.001
ADL score	38 ± 5	39 ± 5	28 ± 6	0.006
UCLA score	18 ± 4	19 ± 4	12 ± 4	<0.001
SF36 score	50 ± 20	50 ± 19	45 ± 21	0.005
SAS score	43 ± 10	44 ± 10	40 ± 10	<0.001
<b>Postoperative Outcomes</b>				
Active Abduction (°)	103 ± 22	94 ± 19	107 ± 26	<0.001
Forward Extension (°)	100 ± 23	147 ± 24	134 ± 26	<0.001
Internal Rotation score	4 ± 1	3 ± 1	4 ± 1	<0.001
External Rotation (°)	49 ± 16	47 ± 16	36 ± 12	<0.001
SET score	7 ± 3	7 ± 2	6 ± 3	<0.001
Constant score	38 ± 15	43 ± 11	31 ± 18	<0.001
ADL score	39 ± 5	39 ± 5	24 ± 6	<0.001
UCLA score	30 ± 4	31 ± 4	29 ± 6	0.010
SF36 score	51 ± 32	50 ± 25	46 ± 35	<0.001
SAS score	52 ± 12	51 ± 12	48 ± 12	<0.001
<b>Change from Preoperative to Postoperative Outcomes</b>				
Δ Active Abduction (°)	21 ± 36	18 ± 26	48 ± 43	<0.001
Δ Forward Extension (°)	54 ± 34	53 ± 26	61 ± 46	0.001
Δ Internal Rotation Score	1 ± 1	2 ± 2	1 ± 2	<0.001
Δ External Rotation (°)	28 ± 20	31 ± 18	34 ± 21	<0.001
Δ SET score	4 ± 1	4 ± 1	4 ± 1	0.001
Δ Constant score	28 ± 15	30 ± 15	27 ± 18	0.126
Δ ADL score	18 ± 25	19 ± 25	14 ± 28	0.002
Δ UCLA score	16 ± 8	16 ± 8	17 ± 7	0.144
Δ SF36 score	46 ± 31	39 ± 25	38 ± 41	0.001
Δ SAS score	32 ± 13	31 ± 12	29 ± 16	0.023

CI = Confidence Interval; BMI = Body Mass Index; SET = Simple Shoulder Test; ADL = Activities of Daily Living; AFE = Active Forward Extension; ABD = Active Abduction; ER = Active External Rotation; CR = Constant Score; SAS = Shoulder Activity Scale; SF36 = Short-Form 36 Health Survey; UCLA = University of California Los Angeles Shoulder Survey; SF36 = Shoulder Pain and Disability Index; CR = Shoulder Rotator Cuff Score; CR = Change from Preoperative to Postoperative; aTSA = Anatomic Total Shoulder Arthroplasty; RSA = Reverse Total Shoulder Arthroplasty.

\* p < 0.05 indicated to indicate statistical significance.

Table 2: Pre and post-operative ADL function for revision-free aTSA and RSA patients.

Activity	Normal (n=253)	Mildly Difficult (n=253)	Very Difficult (n=253)	Unable (n=253)
<b>Preoperative (aTSA)</b>				
Comfortably Sleep	3 (1%)	39 (17%)	186 (80%)	7 (3%)
Do Backward Spots	8 (4%)	58 (26%)	187 (80%)	1 (0%)
Do Usual Activities	17 (8%)	64 (29%)	71 (28%)	21 (12%)
Personal Hygiene / Toilet Needs	47 (22%)	77 (35%)	65 (29%)	8 (4%)
Put on Button-Up Shirt	11 (5%)	32 (15%)	86 (38%)	25 (10%)
Put on Coat	7 (3%)	48 (22%)	91 (40%)	18 (8%)
Put on Pants	12 (5%)	71 (32%)	101 (45%)	9 (5%)
Put on Undershirt/Sweater	9 (4%)	31 (14%)	99 (44%)	18 (8%)
Remove Object from Back Pocket	8 (4%)	29 (13%)	164 (73%)	10 (4%)
Take Bath Behind Back	2 (1%)	13 (6%)	88 (39%)	14 (6%)
Wash Back / Fasten Bra	4 (2%)	13 (6%)	107 (47%)	11 (5%)
Wash Comb Hair	18 (8%)	34 (15%)	48 (21%)	37 (17%)
<b>Preoperative (RSA)</b>				
Comfortably Sleep	125 (17%)	34 (46%)	14 (18%)	2 (3%)
Do Backward Spots	109 (14%)	34 (46%)	24 (32%)	2 (3%)
Do Usual Activities	139 (18%)	24 (32%)	18 (24%)	4 (5%)
Personal Hygiene / Toilet Needs	165 (22%)	13 (18%)	4 (5%)	2 (3%)
Put on Button-Up Shirt	72 (9%)	4 (5%)	4 (5%)	0 (0%)
Put on Coat	134 (18%)	32 (43%)	18 (24%)	1 (1%)
Put on Pants	129 (17%)	14 (19%)	1 (1%)	0 (0%)
Put on Undershirt/Sweater	96 (13%)	82 (110%)	4 (5%)	0 (0%)
Remove Object from Back Pocket	123 (16%)	24 (32%)	13 (17%)	2 (3%)
Take Bath Behind Back	111 (15%)	44 (59%)	13 (17%)	6 (8%)
Wash Back / Fasten Bra	85 (11%)	40 (54%)	21 (28%)	1 (1%)
Wash Comb Hair	158 (21%)	4 (5%)	1 (1%)	0 (0%)
<b>Postoperative (aTSA)</b>				
Comfortably Sleep	7 (3%)	22 (10%)	189 (87%)	1 (0%)
Do Backward Spots	1 (0%)	19 (9%)	137 (62%)	12 (6%)
Do Usual Activities	3 (1%)	20 (9%)	207 (94%)	1 (0%)
Personal Hygiene / Toilet Needs	19 (8%)	21 (10%)	27 (13%)	11 (5%)
Put on Button-Up Shirt	4 (2%)	24 (11%)	207 (94%)	1 (0%)
Put on Coat	2 (1%)	22 (10%)	177 (80%)	1 (0%)
Put on Pants	3 (1%)	19 (9%)	209 (94%)	2 (1%)
Put on Undershirt/Sweater	6 (3%)	12 (6%)	187 (85%)	1 (0%)
Remove Object from Back Pocket	4 (2%)	1 (1%)	22 (10%)	44 (20%)
Take Bath Behind Back	1 (0%)	1 (1%)	18 (8%)	20 (9%)
Wash Back / Fasten Bra	8 (4%)	1 (1%)	12 (6%)	29 (13%)
Wash Comb Hair	5 (2%)	12 (6%)	137 (62%)	26 (12%)
<b>Postoperative (RSA)</b>				
Comfortably Sleep	45 (59%)	21 (28%)	1 (2%)	0 (0%)
Do Backward Spots	32 (42%)	12 (16%)	1 (2%)	0 (0%)
Do Usual Activities	38 (51%)	17 (22%)	4 (5%)	1 (1%)
Personal Hygiene / Toilet Needs	49 (64%)	17 (22%)	4 (5%)	1 (1%)
Put on Button-Up Shirt	28 (37%)	24 (32%)	2 (3%)	0 (0%)
Put on Coat	41 (54%)	19 (25%)	1 (2%)	0 (0%)
Put on Pants	49 (64%)	19 (25%)	1 (2%)	0 (0%)
Put on Undershirt/Sweater	38 (50%)	20 (26%)	1 (2%)	0 (0%)
Remove Object from Back Pocket	34 (45%)	20 (26%)	1 (2%)	0 (0%)
Take Bath Behind Back	27 (36%)	20 (26%)	1 (2%)	0 (0%)
Wash Back / Fasten Bra	28 (37%)	17 (22%)	1 (2%)	0 (0%)
Wash Comb Hair	44 (58%)	11 (15%)	1 (2%)	0 (0%)

ADL = Activities of Daily Living; aTSA = Anatomic Total Shoulder Arthroplasty; RSA = Reverse Total Shoulder Arthroplasty.

Table 3: Odds of RSA patients reporting better postoperative ADL function compared to aTSA patients\* adjusted for age, sex, preoperative AFE, ABD, ER, preoperative rotator cuff pathology.

Activity	Odds Ratio (95% CI)†	p-value‡
Comfortably Sleep	1.01 (0.40 - 2.17)	0.983
Do Backward Spots	0.76 (0.30 - 1.81)	0.607
Do Usual Activities	0.68 (0.32 - 1.41)	0.307
Personal Hygiene / Toilet Needs	0.51 (0.22 - 1.23)	0.119
Put on Button-Up Shirt	0.22 (0.14 - 0.32)	0.000
Put on Coat	0.22 (0.10 - 0.44)	0.005
Put on Undershirt / Sweater	0.35 (0.14 - 0.94)	0.033
Remove Object from Back Pocket	0.11 (0.04 - 0.35)	0.001
Take Bath Behind Back	0.11 (0.04 - 0.35)	0.001
Wash Back / Fasten Bra	0.11 (0.04 - 0.35)	0.001
Wash Comb Hair	0.35 (0.14 - 0.94)	0.033

Odds Ratio (95% CI) = Odds Ratio (95% Confidence Interval); AFE = Active Forward Extension; ABD = Active Abduction; ER = Active External Rotation; CR = Constant Score.

\* All p-values are univariate. Level of function was defined as normal, mild, or very difficult.

† Odds ratios represent univariate odds of reporting better function for patients in the RSA group relative to the aTSA group.

‡ p < 0.05 indicated to indicate statistical significance.