An Aged-Stratified Outcome Comparison Following Reverse Total Shoulder Arthroplasty for Cuff Intact Arthritis versus Cuff Tear Arthropathy

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Background: For patients with rotator cuff intact arthritis, reverse total shoulder arthroplasty (RTSA) may be preferred to total shoulder arthroplasty (TSA), especially in cases with significant glenoid retroversion, altered glenoid anatomy, or risk of future rotator cuff insufficiency. The objective of this study was to compare outcomes following RTSA in patients with cuff intact arthritis (CIA) versus those with cuff tear arthropathy (CTA), stratified by age.

Methods: We retrospectively reviewed consecutive patients >50 years old who underwent RTSA between 2019 and 2021. Patients were classified into either CIA or CTA, which was confirmed by direct visualization of the rotator cuff at the time of surgery. Patients were excluded if surgery was done as a revision arthroplasty, for fracture, or for inadequate data. Pre- and post-operative data were collected including: shoulder forward flexion (FF), external rotation (ER), internal rotation (IR) [converted to a numerical value], FF and ER strength; patient outcome scores including: American Shoulder and Elbow Surgeons (ASES) score, Subjective Shoulder Value (SSV), and Visual Analog Scale (VAS) for pain; and radiographic data including: Walch classification, glenoid retroversion, and reverse shoulder arthroplasty (RSA) angle. Patients were stratified into 3 age groups: <65, 65 – 75, and 75+. Paired samples t tests were done comparing the CIA and CTA cohorts in each age group.

Results: After exclusion, 162 total shoulders (91 female) were reviewed. Mean follow-up was 19 months. In the CIA cohort, 52% had either a B2 or B3 glenoid. In the CTA cohort, 56% had an A1 glenoid. Pre-operative retroversion in the CIA cohort was significantly more than in the CTA cohort in the <65 (20.4° ± 14.8 vs 5.0° ± 7.7, $p < 0.001$) and 65 – 75 (15.2° ± 9.9 vs 7.9° ± 9.7, $p < 0.01$) age groups, but not in the 75+ (8.4° ± 9.6 vs 5.0° ± 8.4, $p = 0.15$) group. There was no difference in pre- and post-operative RSA angle across all age groups. Detailed short term follow up is presented in Tables 1-4. In both cohorts, all age groups had an increase in FF and ER strength. In the <65 group, an increase in post-operative FF strength in the CTA cohort was significantly more than in the CIA cohort (1.4 ± 0.6 vs 0.1 ± 0.6, $p < 0.001$), as was ER strength (1.0 ± 0.6 vs 0.1 ± 0.6, $p < 0.001$). This difference was less pronounced in the older age groups. When all ages were grouped together, the CIA cohort had significantly more post-operative ER (22 ± 23 vs 5 ± 21, $p<0.001$) and IR (1.1 ± 2.0 vs -0.5 ± 2.7 $p<0.001$), compared to the CTA cohort. In both cohorts, all age groups had similar ASES, VAS, and SSV, although when all ages were grouped together, the post-operative ASES was significantly higher in the CIA cohort (85.8 ± 15.1 vs 77.1 ± 18.2, $p < 0.01$). Post-operative infection was noted in 1 CIA and 1 CTA patient and dislocation in 1 CIA and 2 CTA patients.

Conclusions: The CIA cohort had more pre-operative glenoid retroversion when compared to the CTA cohort, with a more pronounced difference in younger patients. Younger patients with CTA have a greater increase in FF and ER strength after RTSA, when compared to older patients. When all ages are combined, the CIA cohort had greater post-operative ER and IR, and higher ASES score, when compared to the CTA cohort.

Table 1. Pre- and Post-Operative Range of Motion								
	FF			ER			IR	
	Pre-Op	Post-Op		Pre-Op	Post-Op		Pre-Op	Post-Op
Age (yr) <65								
CIA (n=13)	117 ± 26	142 ± 45		28 ± 15	49 ± 27		4.5 ± 1.6	5.3 ± 1.5
CTA (n=19)	70 ± 50	148 ± 27		33 ± 25	37 ± 14		4.3 ± 2.0	4.9 ± 1.7
p-value	**0.02**	0.61		0.52	0.11		0.75	0.59
Age (yr) 65 - 75								
CIA (n=23)	102 ± 26	155 ± 16		23 ± 15	45 ± 20		3.7 ± 1.0	5.6 ± 1.6
CTA (n=45)	94 ± 48	144 ± 29		33 ± 19	37 ± 14		4.9 ± 2.0	4.2 ± 1.6
p-value	0.49	0.09		**0.04**	0.06		**0.01**	**<0.01**
Age (yr) 75+								
CIA (n=24)	99 ± 25	141 ± 26		20 ± 17	39 ± 13		3.5 ± 1.8	4.3 ± 1.5
CTA (n=38)	87 ± 49	139 ± 27		29 ± 17	35 ± 11		4.5 ± 2.2	4.1 ± 1.1
p-value	0.27	0.82		0.06	0.22		0.1	0.49
All ages								
CIA (n=60)	104 ± 26	147 ± 29		23 ± 16	43 ± 19		3.8 ± 1.5	5 ± 1.6
CTA (n=102)	89 ± 49	143 ± 28		31 ± 20	36 ± 13		4.7 ± 2.1	4.3 ± 1.5
p-value	**0.03**	0.44		**0.01**	**0.01**		**0.01**	**0.01**

CIA (Cuff Intact Arthritis); CTA (Cuff Tear Arthropathy); FF (Forward Flexion); ER (External Rotation); IR (Internal Rotation)

Table 2. Pre- and Post-Operative Strength							
	FF Strength				ER Strength		
	Pre-Op	Post-Op	Difference		Pre-Op	Post-Op	Difference
Age (yr) <65							
CIA (n=13)	4.8 ± 0.4	4.9 ± 0.3	0.1 ± 0.6		4.8 ± 0.4	4.9 ± 0.3	0.1 ± 0.6
CTA (n=19)	3.6 ± 0.7	4.8 ± 0.4	1.4 ± 0.6		3.6 ± 3.3	4.6 ± 0.5	1.0 ± 0.6
p-value	**<0.001**	0.57	**<0.001**		**<0.001**	0.07	**<0.001**
Age (yr) 65 - 75							
CIA (n=23)	4.3 ± 0.5	4.9 ± 0.3	0.5 ± 0.5		4.5 ± 0.5	4.7 ± 0.5	0.1 ± 0.6
CTA (n=45)	3.8 ± 0.7	4.6 ± 0.6	0.7 ± 0.7		3.9 ± 0.8	4.6 ± 0.5	0.6 ± 0.8
p-value	**0.01**	**0.02**	0.48		**<0.01**	0.24	**0.05**
Age (yr) 75+							
CIA (n=24)	4.3 ± 0.5	4.9 ± 0.3	0.5 ± 0.6		4.3 ± 0.5	4.9 ± 0.2	0.5 ± 0.5
CTA (n=38)	3.8 ± 0.9	4.8 ± 0.4	1.1 ± 1.1		3.8 ± 0.9	4.6 ± 0.5	0.7 ± 1.1
p-value	**<0.01**	0.34	**0.04**		**0.02**	**<0.01**	0.46
All ages							
CIA (n=60)	4.4 ± 0.5	4.9 ± 0.3	0.4 ± 0.6		4.5 ± 0.5	4.9 ± .4	0.3 ± 0.6
CTA (n=102)	3.8 ± 0.8	4.7 ± 0.5	0.9 ± 0.9		3.8 ± 0.8	4.6 ± 0.5	0.7 ± 0.9
p-value	**<0.001**	**0.01**	**<0.001**		**<0.001**	**<0.01**	**<0.01**

CIA (Cuff Intact Arthritis); CTA (Cuff Tear Arthropathy); FF (Forward Flexion); ER (External Rotation)

Table 3. Patient Reported Outcomes							
	ASES		VAS		SSV		
	Pre-Op	Post-Op	Pre-Op	Post-Op	Pre-Op	Post-Op	
Age (yr) <65							
CIA (n=13)	43.8 ± 15.4	82.6 ± 20.1	7.1 ± 1.8	0.8 ± 1.7	36 ± 17	76 ± 30	
CTA (n=19)	35.8 ± 24.1	68.1 ± 22.1	6.8 ± 2.4	1.6 ± 2.1	23 ± 18	78 ± 25	
p-value	0.39	0.09	0.76	0.31	0.06	0.91	
Age (yr) 65 - 75							
CIA (n=23)	36.4 ± 13.3	92.0 ± 9.4	7.9 ± 2.1	0.5 ± 1.2	36.2 ± 20.5	96.2 ± 6.1	
CTA (n=45)	35.3 ± 16.3	78.1 ± 17.2	7.0 ± 2.3	1.1 ± 1.8	33.0 ± 16.6	84.9 ± 19.5	
p-value	0.8	**0.001**	0.13	0.2	0.52	**0.01**	
Age (yr) 75+							
CIA (n=24)	33.8 ± 18.6	81.2 ± 14.8	8.2 ± 1.8	0.9 ± 1.6	33 ± 23	88 ± 17	
CTA (n=38)	35.8 ± 15.0	80.8 ± 15.9	7.5 ± 2.4	0.9 ± 1.3	35 ± 23	83 ± 20	
p-value	0.69	0.94	0.22	0.91	0.74	0.3	
All ages							
CIA (n=60)	37.0 ± 16.0	85.8 ± 15.1	7.8 ± 1.9	0.7 ± 1.5	34 ± 21	89 ± 20	
CTA (n=102)	35.6 ± 17.2	77.1 ± 18.2	7.1 ± 2.3	1.1 ± 1.7	32 ± 20	83 ± 21	
p-value	0.63	**<0.01**	0.06	0.16	0.36	0.09	

CIA (Cuff Intact Arthritis); CTA (Cuff Tear Arthropathy); ASES (American Shoulder and Elbow Surgeon Score); VAS (Visual Analog Scale for pain); SSV (Subjective Shoulder Value)

Table 4. Radiographic Data					
	Retroversion			RSA	
	Pre-Op	Post-Op		Pre-Op	Post-Op
Age (yr) <65					
CIA (n=13)	20.4 ± 14.8	4.7 ± 6.8		21.1 ± 10.6	-1.0 ± 5.4
CTA (n=19)	5.0 ± 7.7	4.8 ± 5.7		21.2 ± 8.5	0.8 ± 7.0
p-value	**<0.001**	0.95		0.97	0.46
Age (yr) 65 - 75					
CIA (n=23)	15.2 ± 9.9	7.1 ± 3.6		19.9 ± 7.0	0.6 ± 5.2
CTA (n=45)	7.9 ± 9.7	5.9 ± 4.5		19.7 ± 7.4	0.3 ± 6.2
p-value	**<0.01**	0.27		0.92	0.84
Age (yr) 75+					
CIA (n=24)	8.4 ± 9.6	5.6 ± 8.0		20.9 ± 14.6	1.1 ± 5.1
CTA (n=38)	5.0 ± 8.4	5.7 ± 4.7		20.1 ± 8.5	-0.3 ± 4.8
p-value	0.15	0.95		0.77	0.28
All ages					
CIA (n=60)	13.6 ± 11.8	6.0 ± 6.3		20.5 ± 11.1	0.5 ± 5.1
CTA (n=102)	6.3 ± 8.9	5.6 ± 4.8		20.1 ± 8.0	0.1 ± 5.9
p-value	**<0.001**	0.69		0.77	0.73

CIA (Cuff Intact Arthritis); CTA (Cuff Tear Arthropathy); RSA (Reverse Shoulder Arthroplasty angle)