Long-Term Results of Reverse Total Shoulder Arthroplasty: Survival, Radiographic, Functional, and Clinical Outcomes with Over 10 Years of Follow-up

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INTRODUCTION:

Reverse total shoulder arthroplasty (RTSA) has been demonstrated to reliably improve pain and functional outcomes and has become increasingly popular since its introduction in 2004, due to the expanding indications and an aging population. Few studies have investigated the long-term outcomes of RTSA. The purpose of this study is to report on the prosthesis survival, and radiographic, functional, and clinical outcomes of RTSA with a minimum 10 years of follow-up.

METHODS:

All RTSA procedures performed between October 2007 and February 2014 in a single hospital. The prosthesis survival rate was calculated by Kaplan-Meier survival analysis using revision for any reason as the endpoint.

For follow-up results beyond 10 years, cases with confirmed deceased or unavailable to come in to follow-up were excluded. Patients followed for over 10 years underwent a range of motion (ROM; anterior elevation [AE], abduction [ABD], external rotation [ER], and internal rotation [IR]), ASES Score (pain score and functional scores on the ipsilateral and contralateral side) as patient-reported outcome measures and radiographic evaluation were investigated. Radiographic evaluations included scapular notching, radiolucency, heterotopic ossification, lateralization shoulder angles (LSA), distalization shoulder angle (DSA), lateral humeral offset (LHO), and acromion humeral offset (AHO). ASES Score were compared in the ipsilateral and contralateral sides with Wilcoxon signed-rank test. All statistical analyses were conducted using Stata 18.0, with a significance level determined to be a p value < 0.05.

RESULTS:

A total of 206 shoulders were identified in 194 patients, with a minimum follow-up period of 10 years after RTSA. The median age at the time of surgery was 68 (range: 43 - 96) years, with the mean follow-up period of 11.0 years. Nine of the 206 cases underwent revision following RTSA, including three cases of infection, three cases of dislocation, one case of liner wear, and two cases of glenoid component displacement. The 5-year implant survival rate was 95.9% (95% confidence interval [CI] 91.5%-98.0%), and the 10-year rate was 92.1% (95% CI: 83.6%-96.3%). (Figure 1)

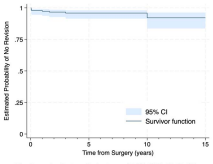
Out of 194 patients with 206 shoulders, 32 patients with 36 shoulders were deceased. Additionally, 58 patients with 60 shoulders could not be contacted, and 11 patients declined any contacts for research due to advanced age. Finally, 52 patients with 54 shoulders were available for follow-up beyond 10 years and 31 patients with 32 shoulders were available for radiographic analyses. (Figure 2)

For 54 cases over 10 years of follow-up outcomes, the demographics are shown in Table 1. All 54 patients underwent a deltopectoral approach, with the same in-lay implant and cementation for the humerus. The median ROM at the final follow-up was 160° (interquartile range [IQR]: 140° - 170°) for AE, 160° (IQR: 130° - 170°) for ABD, and 37.5° (IQR: 30° - 50°) for ER, respectively. The median level reached by IR was L2/3 (IQR: T12 - L5). The ASES Score at the final follow-up ($n = 54$) demonstrated a median pain score of 50 (IQR: 25-50) and a median functional score of 36.7 (IQR: 5-48.3) on the ipsilateral side. In comparison to the preoperative score ($n = 32$), the pain score and the functional score on the ipsilateral side demonstrated a statistically significant improvement ($p < 0.0001$), whereas no such difference was observed on the contralateral side ($p = 0.300$). (Table 2) In radiographic analyses, scapular notching was observed in 23 shoulders (71.9%) and classified as grade III and IV in 7 shoulders (21.9%). Glenoid radiolucency was observed in 8 shoulders (25%) and grade 5 in 2 shoulders (6.3%), indicating migration. Humeral radiolucency was observed in 9 shoulders (28.1%) and grade 5 in 1 shoulder (3.1%). (Table 3)

DISCUSSION AND CONCLUSION:

The long-term results of RTSA were favorable, with a good ROM and ASES score that do not appear to deteriorate over time. The 10-year survival rate was 92.1%, which is consistent with other studies and suggests an overall high success rate with good satisfaction and outcome for patients with RTSA.

Figure 1. Kaplan–Meier survival estimate of RTSA



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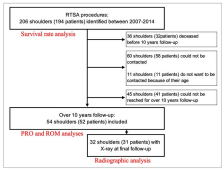
RTSA, reverse total shoulder arthroplasty; CI, confidence interval

Figure 2. RTSA over 10 years postoperatively



RTSA, reverse total shoulder arthroplasty; PRO, patient-reported outcome; ROM, range of motion

Table 1. Demographics at surgery

Characteristics (n = 54)		
Gender, n (%)		
	Female	22 (40.7)
	Male	32 (59.3)
Side, n (%)		
	Left	24 (44.4)
	Right	30 (55.6)
Age, median (IQR)		62.5 (47 - 82)
BMI, kg/m², median (IQR)		27.7 (21.1 - 39.7)
Smoking, n (%)		
	No	25 (46.3)
	Former Smoker	25 (46.3)
	Yes	4 (7.4)
Diagnosis, n (%)		
	RCT Arthropathy	24 (44.4)
	Failed Shoulder Replacement	15 (27.8)
	Osteoarthritis	6 (11.1)
	Fracture sequelae	4 (7.4)
	Acute Fracture	3 (5.6)
	Rheumatoid Arthritis	2 (3.7)
Surgery		
	Trabecular Metal™ Reverse Shoulder	54 (100)
	Cemented	54 (100)
	Glenosphere Size 36mm	54 (100)

n, number of shoulders; IQR, interquartile range; BMI, body mass index; RCT, rotater cuff tear

Table 2. ASES Score at pre- and post-RTSA

ASES Score		Preoperative (n = 32)	Postoperative (n = 54)	p-value
Pain Score, median [IQR]		20 (0 - 50)	50 (25 - 50)	< 0.0001
Function Score, median [IQR]				
	Ipsilateral	18.3 (0 - 41.7)	36.7 (5 - 48.3)	< 0.0001
	Contralateral	42.5 (20 - 50)	43.3 (10 - 50)	0.300
Composite Score, median [IQR]				
	Ipsilateral	40 (5 - 71.7)	85 (40 - 98.3)	< 0.0001
	Contralateral	59.2 (26.7 - 100)	90.1 (50 - 100)	< 0.0001

Postoperative values were earned at the final follow-up.
Composite Score (max 100) = Pain score (max 50) + Function Score (max 50). Pain Score is not divided by sides. Wilcoxon signed-rank tests were performed (n = 32).

ASES, American Shoulder and Elbow Surgeons Shoulder Score; IQR, interquartile range

Table 3. Radiographic Outcomes

Radiographic Outcomes at final follow-up (n = 32)			
Glenoid migration, n (%)	2 (6.3)		
Glenoid radiolucency, n (%)		Humerus radiolucency, n (%)	
None	24 (75)	None	23 (71.9)
Grade I	2 (6.3)	Grade I	6 (18.8)
Grade II	3 (9.4)	Grade II	2 (6.3)
Grade III	1 (3.1)	Grade III	0 (0)
Grade IV	0 (0)	Grade IV	0 (0)
Grade V	2 (6.3)	Grade V	1 (3.1)
Scapular notching, n (%)		Other	
None	9 (28.1)	LSA, median (IQR)	60° (75° - 86°)
Grade I	12 (37.5)	DSA, median (IQR)	54° (44° - 57°)
Grade II	4 (12.5)	LHO, median (IQR), mm	10.3 (5.4 - 20.3)
Grade III	3 (9.4)	AHO, median (IQR), mm	36.3 (27.6 - 44.9)
Grade IV	4 (12.5)	Heterotopic ossification	3 (9.4)

LSA, lateralization shoulder angles; DSA, distalization shoulder angle; LHO, Lateral humeral offset; AHO, acromion humeral offset