Comparison of Clinical Outcomes after Medialized Versus Lateralized Center of Rotation Design in Patients with Bilateral Reverse Shoulder Arthroplasty

Dimitri Joseph Mabarak[1], Charles Cogan[1], Midhat Patel[2], Nabil Mehta[3], Arlene Rose Maheu, Surena Namdari[4], Daniel Ehren Goltz[5], Jason Ho[6], Joseph P Iannotti, Eric Thomas Ricchetti[6], Vahid Entezari[1]
[1]Cleveland Clinic Foundation, [2]Dept of Orthopedics Univ Ariz COM Phx, [3]Rothman Institute of Thomas Jefferson University, [4]Rothman Institute, [5]Rothman Orthopaedic Institute, [6]Cleveland Clinic

INTRODUCTION:

There has been an evolution of reverse shoulder arthroplasty (RSA) design in the past two decades and there has been limited research in direct comparison of different design parameters and their clinical outcome. The original RSA design included a hemispherical glenosphere with a medialized center of rotation (MCR) and a 155° neck shaft angle (NSA) humeral component. The proposed benefits of this design included decreasing shear force on the glenoid and improving the deltoid moment arm. There were also unique complications with this design, such as scapular notching and improper tensioning of the rotator cuff due to a medialized humerus. Subsequent designs of the RSA have attempted to make the reconstruction more “anatomic,” meaning a more lateralized center of rotation (LCR) and a 135° NSA humeral component. The presumed benefit of these changes is to minimize the risk of scapular notching and improve the length-tension relationship of the remaining rotator cuff through increased glenoid offset and by pushing the humerus more lateral. The primary objective of the current study was to compare clinical outcomes of patients who had bilateral RSA with a medialized RSA (medialized glenosphere and inlay humerus with 155° NSA) in one shoulder and lateralized RSA (lateralized glenosphere and inlay humerus with 135° NSA) in the other shoulder. Our hypothesis is that patients will demonstrate similar patient reported outcome measures (PROMs) after LCR and MCR implants while they will show better external rotation (ER) after LCR RSA and better forward elevation (FE) after MCR RSA.

METHODS:

Between February 2010 and March 2023, we identified 15 patients from two high volume academic medical centers with MCR RSA on one side and LCR RSA on the other shoulder. In order to minimize other implant related variability, we chose one implant system for MCR and LCR RSAs. All patients had a minimum of 6 months of follow-up. The American Shoulder Elbow Surgeons (ASES) score, postoperative range of motion (ROM), and reoperation rate were the primary clinical outcomes. All patients were contacted and scheduled to come for an in-person visit and the remaining data was extracted from the electronic medical record at the participating institutions. Statistical analysis was performed using SPSS software package Ver 20.0. We reported median and interquartile range (IQR) for continuous variables and count and percentage for dichotomized variables. Wilcoxon Signed-Rank test was used for comparison of paired continuous variables and McNemar test was used for comparison of paired dichotomized variables. P values < 0.05 was used as the threshold for statistical significance.

RESULTS:

On average, patients were younger when undergoing MCR and older when undergoing LCR RSA [73(8) vs , 70(8), P = 0.0006]. Median follow-up duration was 2 (5) years in the LCR side and 7 (6) years in the MCR side (P = 0.003). Median preoperative FE was 150° (50°) in LCR shoulders and 100° (55°) in MCR shoulders (P = 0.34). Median postoperative FE was 140° (13°) and 150° (20°) in the LCR and MCR shoulders, respectively (P = 0.037). Median preoperative ER was 40° (40°) and 45° (18°) in LCR and MCR shoulders, respectively. Median postoperative ER was 50° (20°) and 45° (30°) in the LCR and MCR shoulders, respectively. There was no statistical difference in PROMs between the two sides (P> 0.05). Median ASES scores were 84 (16) for LCR shoulders and 84 (20) for MCR shoulders. Median ASES pain score was the same at 50 for both LCR and MCR shoulders. Median ASES function score was 35 (11) for LCR shoulders and 33 (13) for MCR shoulders. There were no reoperations in either side at final follow-up.

DISCUSSION AND CONCLUSION:

This study demonstrates comparable clinical outcomes between the LCR and MCR RSA shoulders of patients undergoing bilateral RSA with different implant designs. The MCR shoulders were found to have statistically better post-operative FE as compared to the LCR shoulders, but since this was only 10° and there was no difference in PROMs between the groups, it is unclear if this is clinically significant. With the exception of FE, there was no statistically significant difference among ROM, ASES, satisfaction scores, or reoperation rates. Both ROM and PROMs improvements in this cohort are similar to those reported in the literature for patients undergoing RSA. We are determined to identify more patients with bilateral RSA of LCR and MCR design and to have better clinical follow up to see if differences will arise between implant designs especially with regards to complications and revision rates. In conclusion, this study demonstrates no clinically significant difference in ROM, PROMs, and reoperation rate between RSA with LCR and MCR performed in the same patient in a small cohort of patients.

Table 1. Summary of demographics, patient reported outcome, range of motion and reoperations for LCR and MCR shoulders.

Variables		LCR (n=15)			MCR (n=15)			P value
		N (%)	Median	IQR	N (%)	Median	IQR	
Age at surgery (yr)			73	8		70	8	0.0006*
Follow up (yr)			2	5		7	6	0.003*
Primary Dx	CTA	11 (73)			11 (73)			1.0
	OA	4 (27)			4 (27)			
Pre-op FE (°)			150	50		100	55	0.34
Pre-op ER (°)			40	45		45	18	0.60
Post-op FE (°)			140	13		150	20	0.037*
Post-op ER (°)			50	20		45	30	0.87
ASES total (0-100)			84	16		84	20	0.92
ASES pain (0-50)			50	4		50	5	1.0
ASES function (0-50)			35	11		33	13	0.38
SANE (0-100)			87	39		93	14	1.0
Satisfaction (0-10)			10	3		10	2	1.0
Reoperation (n)		0 (0)			0(0)			1.0

IQR: Interquartile range, Wilcoxon Signed-Rank test was used to compare two paired measurements with non-normal distributions.