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Reverse Total Shoulder Arthroplasty Outcomes with and without Subscapularis Repair: A Retrospective, Comparative Study

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Research Article

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ABSTRACT

Subscapularis repair after a lateralized Reverse shoulder arthroplasty (RSA) remains controversial. It is not known whether this non-anatomic repair can help with Range of motion and/or stability following RSA. The objective of this retrospective study is to determine if there is any difference in stability, range of motion, stability, revision, infection, or surgical time after RSA with or without subscapularis repair. 230 RTSA patients were included in this retrospective review. We collected data on range of motion, surgical time, range of motion, and complications including joint instability. This was analyzed using a multivariable model controlling for age, BMI, sex, and the presence of comorbidities. Instability was determined as a documented dislocation requiring closed or open reduction. Both instability and range of motion measurements were completed by an ABOS Board Certified Orthopaedic Surgeon pre-operatively and at 3, 6, and 12 week follow-up appointments.

INTRODUCTION

Reverse shoulder arthroplasty (RSA) has been used in the United States to treat a variety of shoulder conditions with increasingly good results since 2003. Istorically, the technique for RSA has paralleled traditional total shoulder arthroplasty with concurrent subscapular repair in both procedures. Repair of the subscapularis was thought to give anatomic preservation, provide the potential for improved function, improve joint protection with better closure of the joint, and improve stability of the arthroplasty. However, with the advent of more stable, lateralized systems, surgeons have questioned the need for this non-anatomic repair. For instance, repair of the subscapularis in RSA may be biomechanically unfavorable for deltoid function, as if functions as an adductor instead of an abductor as with anatomic total shoulder arthroplasty [1]. Additionally, with more stable lateralized systems, the subscapularis may be unnecessary for stability. There have been conflicting studies regarding the implications of subscapularis repair in RSA. There is also a lack of studies showing direct quantifiable treatment group comparison within applicable patient populations post RSA clinical

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outcomes which. The objective of this retrospective study is to determine if there is any difference in stability and range of motion after RSA with or without subscapularis repair in lateralized center of rotation RSA.

MATERIALS AND METHODS

A retrospective comparative treatment study was conducted. An initial query of the electronic medical record (EMR) was used to identify patients who received RSA from May 2016 to August 2019. The query was completed utilizing a filter on a single surgeon within an independent orthopedic group and using Current Procedural Terminology (CPT) code 23472 for total shoulder arthroplasty. Patients were excluded from the study if they did not have at least 12 months of follow-up. Patients with previous shoulder surgery were also excluded. Descriptive variables were collected for the population and included age, body mass index (BMI), and relevant comorbidities [2]. The primary outcome variable was postoperative stability of the shoulder replacement. This was evaluated clinically as a yes/no criteria with a single reported dislocation qualifying as "instability" measured at 3-week, 6-week, & 12-week follow-up appointments. Instability/non-instability was assessed by a fellowship-trained shoulder and elbow surgeon.

Secondary outcome measures included Range of motion, surgical time, and postoperative complications. Data was collected from the EMR and stored in a secured electronic research database (REDCap). Internal rotation was recorded within the EMR as Sacrum, L5, L1, T6. These evaluations were then converted to degrees of internal rotation as 30°= sacrum, 50°= L5, 70°=L1, and 90°= T6 for ease of analysis. To prevent transcription error the database was programed with data entry "rules" allowing any input to the database was crosschecked as a valid data entry before it was able to be utilized in this study. Statistical analysis was performed by a trained statistician using SAS software version 9.4 (SAS Institute Inc., Cary, NC, USA). Means and standard deviations were reported as continuous variables, and percentage values will be reported for categorical variables. Logistic regression was used to report instability. Procedure time was compared utilizing a generalized linear model with log link. The range of motion was compared utilizing a mixed model. The odds ratio between two groups and 95% confidence interval for odds ratio were reported. $p< 0.05$ was considered the statistically significant test.

No data monitoring was necessary as this was a retrospective study, though University of Illinois College of Medicine Institutional Review Board (IRB) approval was received on May 28, 2019 (reference IRB #1363070-2).

RESULTS AND DISCUSSION

Table 1. Descriptive statistics.

	Group 1: Subscapularis repair (n=135)	Group 2: No Subscapularis Repair (n=95)	P value
Mean Age (SD)	69.6 (8.6)	72.4 (8.5)	0.014
Mean BMI (SD)	30.9 (6.5)	30.2 (7.3)	0.46
Indication for RSA	-	-	-
Osteoarthritis	56	24	0.819
Rotator Cuff Tear	28	22	0.803
Rotator Cuff Arthropathy	32	22	0.214
Avascular Necrosis	2	0	0.565
Fracture	14	22	0.086
Other	3	3	0.929

Initial query results yielded 350 patients within the sample period. After filtering by the aforementioned criteria, 230 patients were included in the analysis. Of these patients, 95 (41%) did not receive subscapularis repair. The average patient age at the time of surgery was 70.7 years (SD 8.7). Mean BMI was 30.6 (SD = 6.9), and 56.5% were female. (Table I)
Two patients (2.2%) who did not receive subscapularis repair had an instability event compared to 6 of 135 (4.4%) patients with subscapularis repair (p=0.310). Average surgical time was no different between groups (p=0.827).

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There was also no difference in revisions (p=0.310) or infections (p=0.574). To maintain an appropriate sample for comparative analysis, each range of motion movement was independently filtered so that the same population was being tested at each time interval [3]. Therefore the sample size used for multivariable analysis of each range of motion action will be slightly different for each action, as it was possible for there to be a patient who did not have a specific action measured at a follow-up.

The preoperative active forward flexion (n=213) showed a difference of 13.03° (p=0.012). Active forward flexion postoperative differences were at 3 weeks 26.72° (p=0.050), at 6 weeks 5.04° (p=0.549), and at 12 weeks 0.86° (p=0.896). Passive forward flexion (n=227) yielded a preoperative difference of 4.04° (p=0.229). The difference in postoperative passive forward flexion was: at 3 weeks 1.53° (p=0.713), at 6 weeks 5.43° (p=0.110), and at 12 weeks 1.78° (p=0.592). Preoperative active internal rotation (n=226) yielded a difference of 1.96° (p=230). The difference in active internal rotation was: at 3 weeks 1.83° (p=0.372), at 6 weeks 5.56° (p=0.001), and at 12 weeks 1.45° (p=0.341). Passive internal rotation (n=213) preoperative difference was 2.36° (p=167). The difference in passive internal rotation was: at 3 weeks 1.75° (p=0.404), at 6 weeks 4.90° (p=0.005), and at 12 weeks 1.55° (p=0.323). Preoperative active external rotation (n=227) showed a preoperative difference of 3.27° (p=0.065). The postoperative difference in active external rotation was: at 3 weeks 0.70° (p=0.754), at 6 weeks 2.73° (p=0.135), and at 12 weeks 0.50° (p=0.777). Passive external rotation (n=214) yielded a preoperative difference of 3.12° (0.092). The difference in passive external rotation was: at 3 weeks 1.15° (p=0.622), at 6 weeks 2.50° (p=0.188), and at 12 weeks 0.60° (p=0.746).

Subscapularis repair after RSA remains controversial in the literature. Advocates for subscapularis repair cite increased shoulder stability and increased range of motion postoperatively. With lateralized RSA, these concerns are potentially less important, as the implant is inherently more stable and the subscapularis repair is less anatomic. Within this retrospective study, 8 patients (3.5%) experienced post-operational instability. This is consistent with previous studies with have cited instability rates of 1.5-31%. 4.4% with repair vs. 2.1% without repair experienced postoperative instability [4]. No statistical difference was found between these groups, suggesting that the subscapularis repair does not confer significant instability to the RSA. A dislocation rate of 9.2% with failure of subscapularis repair as an independent risk factor for instability. It should be noted that their study did not standardize their implants across their study. In our study, we saw an opposite phenomenon with the majority of dislocation in the subscapularis repair group. The investigators also showed a decrease in shoulder instability with medialized RSA designs. In our study, we showed a relatively low instability rate with a lateralized prosthesis.

In all cases, our study showed at 12 weeks that the patient population had range of motion well within the functional norms associated with activities of daily living.Our study also suggests that subscapularis repair may decrease range of motion after RSA. Patients without subscapularis repair trended higher range of motion in all planes, although this was not statistically significant. These observations are in congruence with a recent biomechanical which showed that in lateralized designs of RSA, the subscapularis is not only stretched significantly longer than an anatomic repair but also the subscapularis repair exerts an addiction moment on the shoulder that is antagonistic to the pull of the deltoid. These findings seem to support the observations made in this study in terms of range of motion.

We found no statistical difference in surgical time for the two groups. We hypothesized that there would be an associated time saving with not repairing the subscapularis. Other published studies show operational times longer than what we recorded. This also is not intuitive, as all else being equal; not repairing the subscapularis would remove that step and would be faster. This could be due to variation between each surgeon, preference, and lack of standardization of start and stop time for recording time of procedure between this and other studies. More study should be done to evaluate if there is a measurable difference in surgical time when repairing or not repairing the subscapularis in RSA.

This retrospective study has several strengths in evaluating the difference between subscapularis and non-subscapularis repair in RSA. It represents a single surgeon's postoperative outcomes across his continued patient population. This holds standard the clinical decisions, surgical preferences, and experience. The measured clinical outcomes were completed by that same surgeon in the clinic permitting a clear standardization of postoperative measurement [5]. There are several limitations to this study. By design, this is a retrospective study and has all the bias associated with a retrospective review. This study was also a cohort study which has its limitation in evaluating two groups compared to a randomized study. This study also represents the experience of a single surgeon at a tertiary care hospital which may not be generalizable across the country (Table 2).

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Table 2. Postoperative outcomes.

	Group 1: Subscapularis repair (n=135)	Group 2: No Subscapularis repair (n=95)	P value
Instability n (%)	6 (4.4)	2 (2.1)	0.31
Revisions n (%)	6 (4.4)	2 (2.1)	0.31
Infections n (%)	2 (1.5)	1 (1)	0.57
Surgical Time (min)	50.9	50.4	0.815

CONCLUSION

We found there was no statistical difference in outcomes for patients who received Reverse Total Shoulder Arthroplasty with or without subscapularis repair. Multivariable analysis yielded no statistical difference in range of motion, stability, revision, infection, or surgical time. This data suggests that subscapularis repair in lateralized RSA may not be necessary. Further study is recommended to further evaluate these results. However, we believe that despite its limitations, we can draw some conclusions regarding subscapularis repair in lateralized designs that were not previously reported in the literature.

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