Does Preoperative Fatty Infiltration of the Infraspinatus Muscle Affect Clinical and Structural Outcomes following Superior Capsule Reconstruction in Irreparable Rotator Cuff Tears?

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INTRODUCTION:

Superior capsule reconstruction (SCR) was developed as a joint-preserving surgical option for patients with irreparable rotator cuff tears (RCTs). In this technique, the graft is attached at the glenoid and greater tuberosity; side-to-side sutures between the graft and remaining posterior rotator cuff (infraspinatus, ISP) are added. Thus, quality of remaining ISP muscles might be an important factor influencing the improvement of the shoulder function and graft integrity after SCR. However, the effect of fatty infiltration (FI) of ISP muscles on functional and structural outcomes after SCR for irreparable RCTs remains unclear. The objective of this study was to assess whether FI severity of ISP affected clinical outcomes and the graft tear rate after SCR.

METHODS: This retrospective study included 169 patients (92 women and 77 men; mean age, 69.1 years) with irreparable RCTs who underwent arthroscopic SCR using fascia lata autografts and completed a minimum 1-year follow up. The FI severity of ISP was evaluated by preoperative magnetic resonance imaging (MRI) according to Goutallier classification and was classified into grades 0-4. We compared the visual analog scale (VAS) for pain, American Shoulder and Elbow Surgeons (ASES) scores, active shoulder range of motion (ROM), and the graft tear rate among five groups. For the statistical analyses, Kruskal-Wallis test followed by pairwise group comparisons using the Dwass-Steel-Critchlow-Fligner procedure was used to compare the values among the five groups based on the FI severity of ISP. Paired t-test or Wilcoxon signed-rank test was used to compare the preoperative and postoperative clinical outcome measures. Additionally, the Wilcoxon rank sum test or Fisher's exact test was used to compare the baseline characteristics between patients with healed grafts and those with graft tears. Then, multivariate logistic regression analysis was performed to identify the independent risk factors for graft tears. Statistical significance was defined as P <0.05.

RESULTS:

MRI scans analysis showed ISP FI grades of 0 in 9 shoulders, 1 in 39, 2 in 59, 3 in 24, and 4 in 38. VAS and ASES scores significantly improved after SCR in all groups (all P<.01) (Table 1). Postoperative VAS and ASES score did not differ significantly among five groups. Active elevation, external rotation, and internal rotation also significantly improved after SCR in all groups (all P<0.05) (Table 2). There was no significant difference in active elevation, external rotation, and internal rotation among five groups. Graft tear rate in shoulders with grade 4 FI of ISP was relatively high, but the difference was not found to be significant (grade 0, 11.1%; grade 1, 5.1%; grade 2, 6.8%; grade 3, 8.3%; grade 4, 21.1%; P=0.15). In the analyses of baseline characteristics, there was a significant difference in preoperative acromiohumeral distance (AHD), Goutallier classification of the subscapularis and infraspinatus, and RCT size (anterior-posterior direction) between patients with healed grafts and those with graft tears (P=0.04, 0.002, 0.04, and 0.03, respectively). Multivariate logistic regression analysis revealed that the Goutallier classification of the subscapularis was an independent risk factor for graft tear (odds ratio 2.89, 95% confidence interval 1.61–5.55, P=0.0003), whereas that of the ISP was not (P=0.44) (Table 3).

DISCUSSION AND CONCLUSION:

Arthroscopic SCR is a reliable surgical option for irreparable posterior-superior RCTs even in patients with severely degenerated ISP. Goutallier classification of the ISP was not an independent risk factor for graft tear after SCR.

Table 1 Change in Visual Analog Scale and American Shoulder and Elbow Surgeons score after Superior Capsule Reconstruction

	Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Overall
VAS						
Preoperative	5.9 ± 3.5	5.3 ± 2.4	6.1 ± 2.2	5.7 ± 2.7	5.7 ± 2.4	5.8 ± 2.5
Postoperative	0.0 ± 0.0	0.4 ± 1.2	0.5 ± 1.0	0.2 ± 0.7	0.8 ± 1.5	0.5 ± 1.1
P value	0.008	< .0001	< .0001	< .0001	< .0001	< .0001
ASES						
Preoperative	42.0 ± 27.1	44.5 ± 22.3	39.8 ± 17.4	41.0 ± 23.0	42.0 ±17.7	41.7 ± 19.9
Postoperative	96.7 ± 6.7	92.3 ± 9.2	92.5 ± 9.3	91.7 ± 11.4	90.3 ± 10.3 e	92.1 ± 9.7
P value	0.004	< .0001	< .0001	< .0001	< .0001	< .0001

Values are presented as means + standard deviations. VAS, visual analog scale for pain; ASES, American Shoulder and Elbow Surgeons score

Table 2 Change in Active Shoulder Ranges of Motion from Preoperative to Postoperative Evaluation

	Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Overall
Active elevation, deg						
Preoperative	108.9 ± 50.6	99.0 ± 51.4	100.0 ± 53.5	84.0 ± 55.4	103.4 ± 53.0	98.7 ± 52.8
Postoperative	165.6 ± 11.6	158.5 ± 19.6	160.3 ± 15.2	157.5 ± 18.9	155.4 ± 24.7	158.6 ± 19.0
P value	0.012	< .0001	< .0001	< .0001	< .0001	< .0001
Active external rotation, deg						
Preoperative	33.9 ± 16.5	33.6 ± 21.1	32.7 ± 16.0	28.1 ± 20.7	23.8 ± 22.0	30.3 ± 19.6
Postoperative	48.9 ± 20.3	49.7 ± 19.3	48.1 ± 16.1	41.7 ± 16.0	42.4 ± 20.2	46.3 ± 17.9
P value	0.04	< .0001	< .0001	0.004	< .0001	< .0001
Active internal rotation						
Preoperative	L4: 4.4 ± 2.7	L4: 3.9 ± 3.0	L3: 4.7 ± 2.8	L3: 5.0 ± 4.0	L4: 4.3 ± 3.1	L4: 4.4 ± 3.1
Postoperative	L1: 7.3 + 3.3	Th12: 8.0 + 2.9	Th12: 8.2 + 2.7	Th11: 8.8 + 2.4	Th12: 7.8 + 2.4	Th12: 8.1 + 2.7
P value	0.008	< .0001	< .0001	< .0001	< .0001	< .0001

Values are presented as means ± standard deviations.

Table 3. Logistic regression analysis showing variables affecting graft tears

	Univariate logistic regression analysis			Multivariate logistic regression analysis		
	Crude OR	**95% CI**	***P*-values**	**Adjusted OR**	**95% CI**	***P*-values**
Acromiohumeral distance, mm	0.79	0.61–1.01	0.06	0.86	0.63–1.13	0.28
Goutallier stage of Sub	3.13	1.83–5.70	<0.0001*	2.89	1.61–5.55	0.0003*
Goutallier stage of ISP	1.58	1.03–2.51	0.0371*	1.23	0.73–2.11	0.44
RCT size (AP), mm	2.17	1.11 4.32	0.0229*	1.47	0.67 3.28	0.34

RCT: rotator cuff tear; AP: anterior-posterior; OR: odds ratio CI: confidence interval; ISP: subscapularis; Sub: subscapularis

* $P < 0.05$