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Title: Is the combination of superior and posterior capsular release more effective than superior capsular release alone in arthroscopic repair of large to massive rotator cuff tears?

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Disclosures:
I (and my co-authors) have
nothing to disclose.



BACKGROUND

- Superior capsular release has been used to achieve adequate reduction with less tension, especially in arthroscopic repair of large to massive rotator cuff tears. (Cho et al. Arthroscopy. 2015., Sugaya et al. JBJS am. 2007.)
- One biomechanical study reported that capsular release resulted in decreased force for repaired cuffs. (Hagiwara et al. JSES. 2020.)
- There have not been a few studies investigating additional posterior capsular release for superior capsular release in arthroscopic repair of large to massive rotator cuff tears.



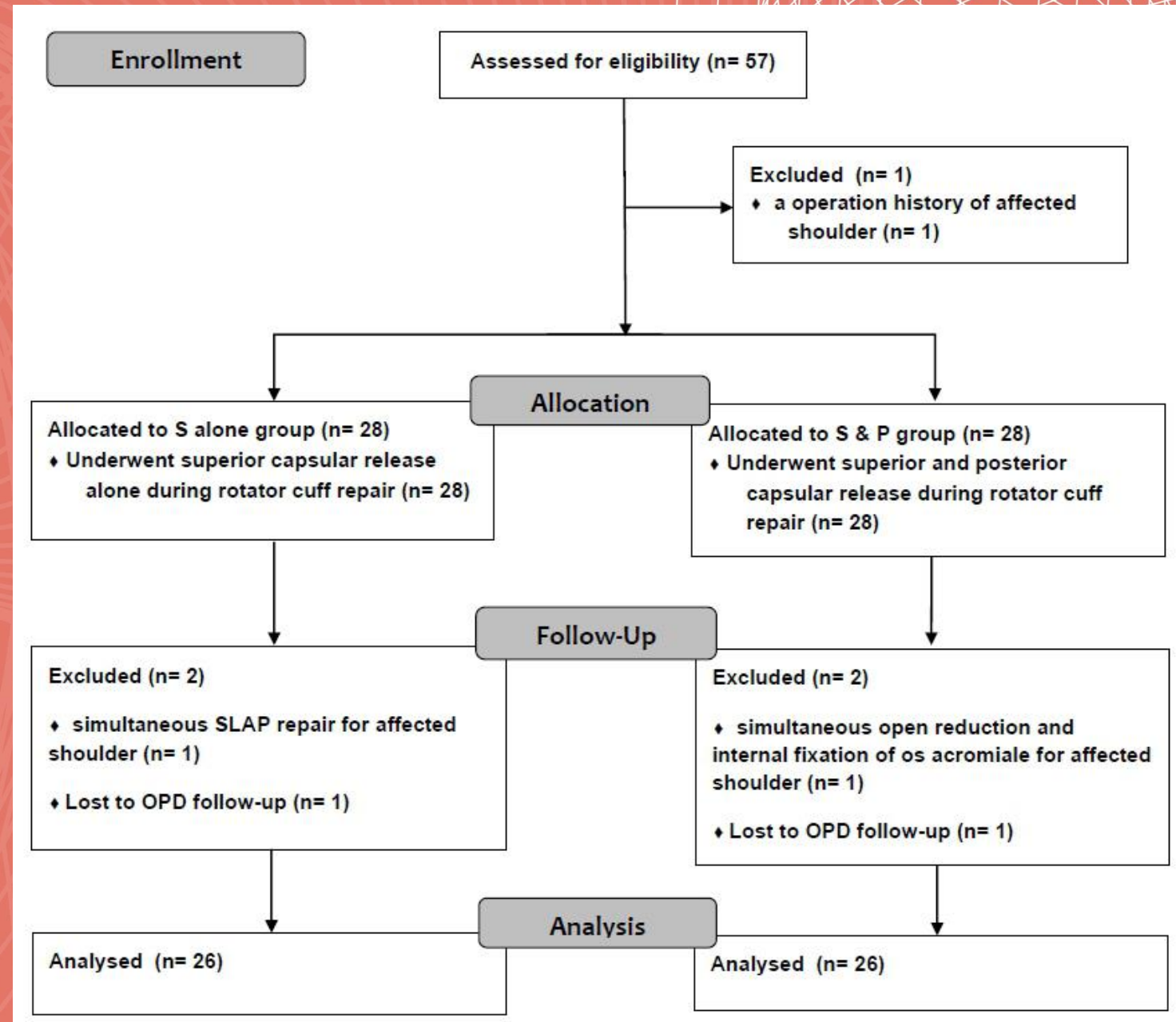
THE AIM OF THIS STUDY

- To analyze the functional and structural outcomes of additional posterior capsular release for superior capsular release in arthroscopic repair of large and massive rotator cuff tears.



METHODS

- This study is a retrospective cohort one.
- The former 26 patients underwent superior capsular release, alone and the latter 26 patients underwent superior and posterior capsular release during arthroscopic repair of large to massive cuff tear.



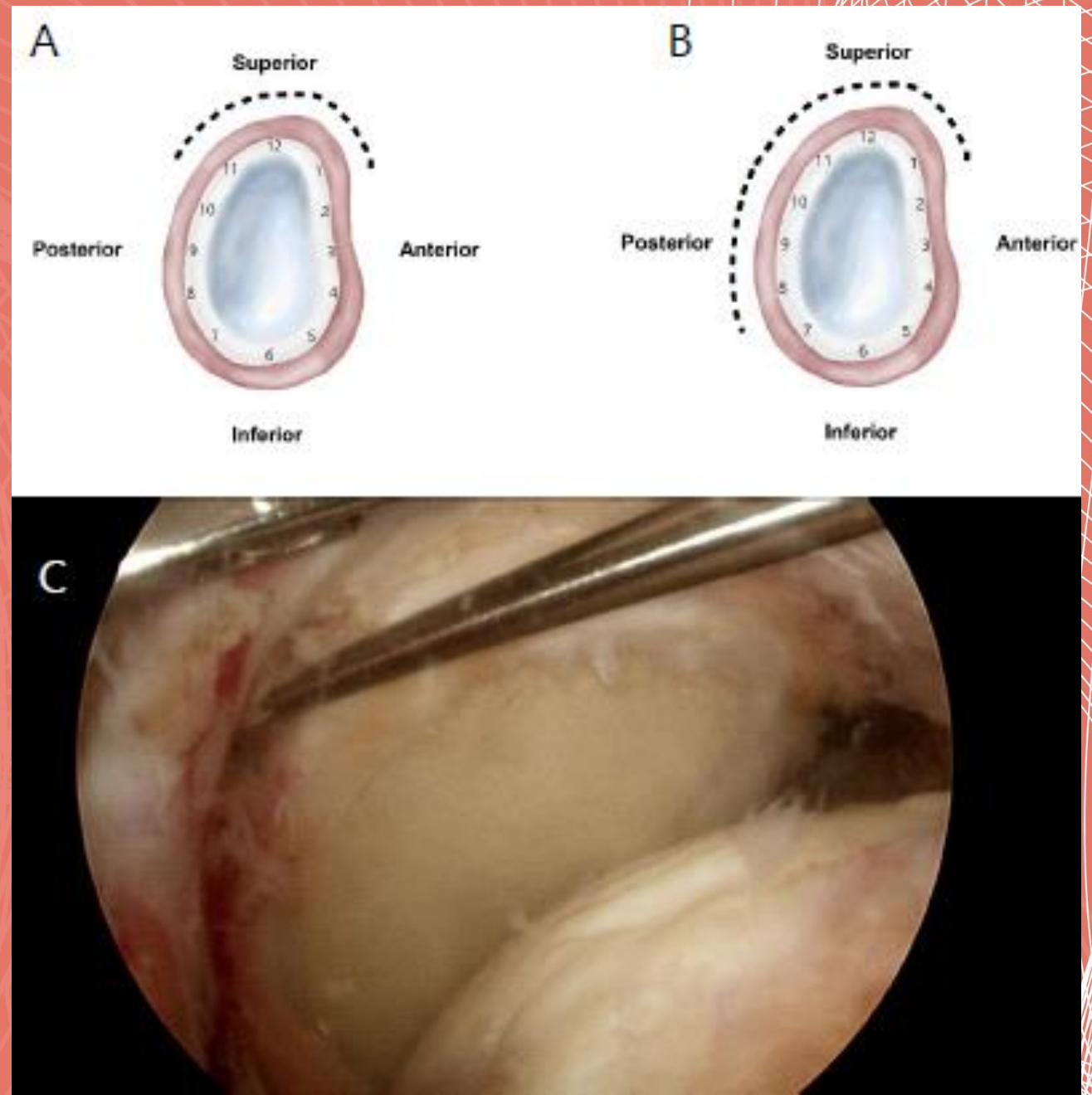
Flow diagram of the present study according to the Consolidated Standards of Reporting Trials (CONSORT) criteria. S alone group: superior capsular release alone group, S & P group: superior and posterior capsular release group



- We categorized a rotator cuff tear measuring 3 to 5 cm as large and a tear measuring larger than 5 cm as massive. In addition, a massive tear was defined as a detachment of at least 2 entire tendons.

- Preoperative and postoperative functional scores were checked.

- Preoperative MRI and postoperative ultrasonography were preformed.



Superior and posterior capsular release. A. Superior capsular release, B. superior and posterior capsular release. C. Arthroscopic view from lateral portal on right shoulder. Meniscus knife was used during posterior capsular release through posterolateral portal and a grasper was used for manipulation of cuffs through posterior portal. Division of capsule on right shoulder: anterior, 1 h 30 m to 4 h 30 m, inferior, 4 h 30 m to 7 h 30 m, posterior, 7 h 30 m to 10 h 30 m, and superior, 10 h 30 m to 1 h 30 m.



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RESULTS

*Factors are presented as the mean ± standard deviation with the range in parentheses. Control group: posterior capsular release, Study group: superior and posterior capsular release. Symptom duration: the duration between symptom onset and operation. BMI: body mass index, VAS: visual analog scale pain score, ASES: American Shoulder and Elbow Surgeons score, Constant: Constant score, FD: fatty degeneration, SS: supraspinatus, IS: infraspinatus, SC: subscapularis, GDFI: global fatty degeneration index. The above analysis was performed using Mann-Whitney U test or t-test for indifferent samples according to the normality of data to evaluate the differences between the mean values of the control group and the study group. For binomial data, chi-square test was used, but if any cell had expected count less than 5, Fisher's exact test was performed. $P < .05$.

Factors	Demographics			
	Control group	Study group	Confidence interval of the difference	p-value
Number	26	26		
Age (years)*	61.6 ± 10.0 (40-81)	64.5 ± 7.4 (52-78)	-7.8-2.0	.236
Gender (male : female)	10 : 16	11 : 15		.267
Dominant : nondominant	20 : 6	20 : 6		1.000
Symptom duration (months)*	20.7 ± 48.1 (1.0-240.0)	16.2 ± 28.4 (1.0-120.0)	-17.5-26.5	.317
Preoperative height (cm) *	162.3 ± 9.7 (145.0-180.0)	150.8 ± 7.9 (145.0-179.0)	-0.4-9.4	.071
Preoperative weight (kg) *	67.8 ± 12.5 (47.0-94.0)	62.3 ± 10.2 (42.0-80.0)	-0.9-11.8	.091
Preoperative BMI (kg/m²)*	25.5 ± 2.6 (19.7-30.1)	25.0 ± 3.4 (17.3-31.5)	-1.2-2.2	.528
Preoperative VAS*	6.2 ± 2.1 (1.0-10.0)	6.6 ± 2.3 (2.0-10.0)	-1.7-0.8	.428
Preoperative ASES*	42.4 ± 17.0 (18.3-86.7)	37.5 ± 19.5 (3.3-78.3)	-5.3-15.1	.336
Preoperative Constant*	53.0 ± 7.9 (37.5-66.5)	52.8 ± 9.2 (30.4-71.8)	-4.6-5.0	.937
Preoperative FD (SS)*	1.5 ± 0.8 (0.0-3.0)	1.5 ± 0.9 (0.0-3.0)	-0.5-0.5	.876
Preoperative FD (IS)*	1.1 ± 1.0 (0.0-4.0)	1.5 ± 0.9 (0.0-3.0)	-0.9-0.2	.125
Preoperative FD (SC)*	0.7 ± 0.7 (0.0-2.0)	0.6 ± 0.7 (0.0-2.0)	-0.3-0.5	.723
Preoperative GFDI*	1.1 ± 0.7 (0.0-2.7)	1.2 ± 0.7 (0.0-2.3)	-0.5-0.3	.522

Factors	Operative Data				
	Control group	Study group	Confidence interval of the difference	p-value	
Number	26	26			*Factors are presented as the mean ± standard deviation with the range in parentheses. Control group: posterior capsular release, Study group: superior and posterior capsular release. Operation time was the duration between the skin incision and suture. RCT: rotator cuff tear, SC: subscapularis, FPR: footprint restoration, LHB: long head of biceps, Debridement was performed for fraying or spontaneous rupture of LHB. Fraying was defined as a LHB lesion less than 50%. Tenodesis or tenotomy was performed in cases with LHB dislocation, subluxation, or tear involving more than 50%. ADCR: arthroscopic distal clavicle resection, ADCR was performed for symptomatic AC arthritis, AC: acromioclavicular joint. PCA: patient-controlled analgesia. Capsulotomy was performed for adhesive capsulitis from 1 h 30 m to 6 h on right shoulder or from 10 h 30 m to 6 h on left shoulder. Rt: right, Lt: left. The above analysis was performed using Mann-Whitney U test or t-test for indifferent samples according to the normality of data to evaluate the differences between the mean values of the control group and the study group. For binomial data, chi-square test was used, but if any cell had expected count less than 5, Fisher's exact test was performed. P<.05.
Operation time (minute)*	104.0 ± 14.4 (65.0-130.0)	97.9 ± 18.4 (70.0-155.0)	-3.1-15.4	.186	
RCT size (cm)*	4.2 ± 0.8 (3.0-6.0)	4.4± 0.7 (3.0-6.0)	-0.7-0.2	.179	
Suture bridge repair	26	26			
Delamination	11	10		.777	
FPR (%)	87.7 ± 18.8 (40.0-100.0)	96.2 ± 9.8 (70.0-100.0)	-16.9-(0.0)	.054	
SC lesion					
Debridement	7	8		.760	
Repair using suture anchor	2	4		.668	
Tendon to Tendon repair	0	0			
LHB lesion					
Debridement	4	5		1.000	
Tenotomy	0	3		.235	
Tenodesis	11	10		.777	
ADCR	1	2		1.000	
Capsulotomy (1 h 30 m to 6 h (Rt) or 10 h 30 m to 6 h (Lt)) for adhesive capsulitis	2	1		1.000	

Variable	Preoperative	Postoperative (2 years)	Confidence interval of the difference	p-value
Control group (26 cases)				
VAS score	6.2 ± 2.1 (1.0-10.0)	1.7 ± 1.1 (0.0-4.0)	3.6-5.3	<.001
ASES score	42.4 ± 17.0 (18.3-86.7)	80.1 ± 12.0 (56.7-100.0)	-44.2-(-31.1)	<.001
Constant score	55.1 ± 7.7 (40.1-68.6)	65.0 ± 4.7 (54.6-73.6)	-12.4-(-7.4)	<.001
Forward elevation (°)	130.0 ± 16.2 (90-150)	144.6 ± 7.6 (130.0-150.0)	-18.6-(-10.6)	<.001
External rotation (°)	55.0 ± 13.0 (30.0-70.0)	68.8 ± 5.9 (60.0-80.0)	-18.3-(-9.4)	<.001
Internal rotation (°)	45.8 ± 8.3 (30.0-60.0)	66.3 ± 9.6 (40.0-80.0)	-23.2-(-18.0)	<.001
Abduction power (kgf)*	2.5 ± 2.0 (0.4-7.5)	5.2 ± 1.5 (2.5-8.5)	-3.3-(-2.2)	<.001
External rotation power (kgf)*	4.3 ± 1.7 (1.0-7.1)	6.7 ± 1.6 (3.5-9.5)	-3.0-(-1.9)	<.001
Internal rotation power (kgf)*	5.1 ± 1.7 (2.5-9.8)	6.9 ± 1.5 (3.5-9.5)	-2.3-(-1.3)	<.001
Study group (26 cases)				
VAS score	6.6 ± 2.3 (2.0-10.0)	1.7 ± 1.3 (0.0-4.0)	4.1-5.7	<.001
ASES score	37.5 ± 19.5 (3.3-78.3)	81.9 ± 12.6 (55.0-100.0)	-50.4-(-38.4)	<.001
Constant score	54.8 ± 9.1 (33.1-73.9)	68.2 ± 4.9 (56.7-77.7)	-16.0-(-10.8)	<.001
Forward elevation (°)	135.4 ± 16.5 (70-150)	147.3 ± 6.0 (130-150)	-16.6-(-7.2)	<.001
External rotation (°)	57.7 ± 14.5 (20-70)	74.2 ± 8.6 (60-90)	-20.3-(-12.8)	<.001
Internal rotation (°)	47.9 ± 7.6 (33.0-55.0)	77.9 ± 12.7 (45.0-90.0)	-33.7-(-26.3)	<.001
Abduction power (kgf)*	1.8 ± 1.8 (0.1-7.8)	4.9 ± 1.2 (2.5-7.5)	-3.7-(-2.5)	<.001
External rotation power (kgf)*	4.1 ± 2.8 (0.7-10.3)	6.7 ± 1.7 (4.0-11.5)	-3.3-(-1.9)	<.001
Internal rotation power (kgf)*	4.4 ± 2.1 (0.8-12.0)	7.8 ± 1.8 (5.2-12.5)	-4.1-(-2.6)	<.001

VAS: visual analogue scale pain score, ASES: American Shoulder and Elbow Surgeons, Control group: superior capsular release, Study group: superior and posterior capsular release. *1 kgf (kilogram force) = 1 kg x 9.8 m/s². The above analysis was performed using the Wilcoxon signed rank test or paired *t* test according to the normality. *P*<.05.

Difference	Control group	Study group	Confidence interval of the difference	p-value
Δ VAS score	4.5 ± 2.0 (0.0-8.0)	4.9 ± 1.9 (1.0-8.0)	-1.6-0.6	.445
Δ ASES score	37.6 ± 16.2 (3.3-70.0)	44.4 ± 14.9 (13.3-76.7)	-15.5-1.9	.122
Δ Constant score	9.9 ± 6.2 (-2.2-21.3)	13.4 ± 6.4 (3.8-28.7)	-7.0-(-0.0)	.050
Δ Forward elevation (°)	14.6 ± 9.9 (0.0-40.0)	11.9 ± 11.7 (0.0-60.0)	-3.3-(8.7)	.154
Δ External rotation (°)	13.8 ± 11.0 (0.0-40.0)	16.5 ± 9.4 (10.0-40.0)	-8.4-3.0	.257
Δ Internal rotation (°)	20.6 ± 6.4 (5.0-35.0)	30.0 ± 9.2 (10.0-50.0)	-13.8-(-5.0)	<.001
Δ Abduction power (kgf)*	2.7 ± 1.4 (0.3-5.4)	3.1 ± 1.5 (-0.3-6.2)	-1.2-(0.4)	.343
Δ External rotation power (kgf)*	2.4 ± 1.4 (0.2-5.2)	2.6 ± 1.7 (-1.0-5.2)	-1.0-(0.7)	.710
Δ Internal rotation power (kgf)*	1.8 ± 1.3 (-1.3-4.0)	3.4 ± 1.8 (-0.3-6.9)	-2.5-(-0.7)	.001

Control group: superior capsular release, Study group: superior and posterior capsular release. VAS: visual analogue scale pain score; ASES: American Shoulder and Elbow Surgeons. Δ: Amount of differences between the preoperative and postoperative (2 years) values. *1 kgf (kilogram force) = 1 kg x 9.8 m/s². The above analysis was performed with the Mann-Whitney U test or t test for independent samples according to the normality of data between the differences in the preoperative and postoperative (2 years) values in the control group and the study group. *P*<.05.

	Study group	Control group	p-value
Retear/No Retear	3/23 (11.5%)	6/20 (23.1%)	.465

Control group: superior capsular release, Study group: superior and posterior capsular release. The above analysis was performed using Fisher's Exact Test. *P*<.05.

DISCUSSION & CONCLUSION

- The group with superior and posterior capsular releases showed a better improvement in internal rotation range and power ($P < .001$ and $P = .001$) than the group with superior release alone.
- Therefore, additional posterior capsular release resulted in increased range and power of internal rotation for superior capsular release in arthroscopic repair of large to massive rotator cuff tears.



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