Eight-Year Follow-up of Arthroscopic Subacromial Balloon Spacer for Massive, Irreparable Rotator Cuff Tears: Exploring Revision Rates and Patient Well-Being for Long-Term Satisfaction

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INTRODUCTION: When nonoperative measures fail, a host of surgical options are available for massive, irreparable rotator cuff tears (MIRCTs), a tear that is challenging to treat, and accounts for 10-40% of rotator cuff abnormalities. There is no consensus on which surgical method is superior and clinical results vary. Here, we focus on the relatively novel approach of arthroscopic subacromial balloon placement for MIRCT and examine patient satisfaction, outcomes, shoulder functionality, pain scores as well as implant survivorship at eight years after surgery.

METHODS: In this IRB-approved study, we prospectively enrolled patients with rotator cuffs that were deemed irreparable on magnetic resonance imaging from 2014-2017. These patients underwent balloon placement and were followed for a minimum of 5 years. Patient demographic characteristics were reported. Preoperative and postoperative acromiohumeral interval, critical shoulder angle, osteoarthritis grade, Constant-Murley (CM) scores, and 12-Item Short Form Health Survey (SF-12) physical and mental scores were collected. Preoperative and postoperative measures were compared using paired-sample t-tests.

RESULTS SECTION: 61 patients were initially included, with 19 (31%) lost to follow-up. The remaining 42 patients (21 female, 21 male) had a mean age of 63.17 ± 7.66 years at time of surgery and were followed for an average of 83.98 ± 9.50 months. 5 patients underwent RTSA (reverse total shoulder arthroplasty) revisions and 1 patient underwent LDTT (latissimus dorsi tendon transfer) revision within two years of the initial surgery. No subsequent revisions were performed beyond this period, resulting in an implant survival rate of 83.33% at the latest follow-up. Noticeable improvements were observed across several metrics from the preoperative visit to the latest follow-up evaluation: average acromiohumeral interval decreased from 7.83 to 6.56 ($p < 0.01$), critical shoulder angle increased from 36.10 degrees to 38.24 ($p < 0.05$), osteoarthritis grade increased from 1.45 to 2.81 ($p < 0.001$), SF-12 physical score increased from 27.40 to 37.69 ($p < 0.001$), Constant-Murley total scores increased from 26.50 to 68.69 ($p < 0.001$). In the latest follow-up, 4 patients (9.52%) reported excellent satisfaction, 20 patients (47.62%) expressed satisfaction, and 18 patients (42.86%) indicated dissatisfaction. Among patients without revisions, excellent satisfaction was reported by 11.43%, satisfaction by 57.14%, and dissatisfaction by 31.43%.

DISCUSSION: At an 8-year follow-up, arthroscopic subacromial balloon placement for MIRCT resulted in low revision surgery rates, moderate patient satisfaction, and significant improvements in various aspects of shoulder functionality, as demonstrated by increased CM scores. No subsequent revisions were performed apart from the initial six revisions within two years of balloon placement. The latest follow-up confirms the effectiveness of subacromial balloon placement as a treatment for this patient group, with a notably high implant survival rate.

CLINICAL RELEVANCE: The application of a balloon spacer implant in MIRCT cases demonstrates moderate satisfaction in the 2023 follow-up with notably high survival rate underscoring the efficacy of subacromial balloon placement for this patient cohort. An enhanced, more durable balloon spacer could amplify satisfaction and minimize revision surgeries to alternative treatments like RTSA.

Table 1. Clinical and radiographic outcome measures of 42 patients**.**

Outcome Measure	Mean ± SD				Mean Difference between 2023 Follow Up and Preoperative (CI)	
	Preoperatively	1 Day Post-op	2019	2023 Follow Up		
Acromiohumeral interval, mm	7.83 ± 1.84	10.60 ± 3.30	7.00 ± 2.58	6.56 ± 2.35	**-1.27****	**(-2.20, -0.34)**
Critical shoulder angle, degrees	36.10 ± 4.13	35.20 ± 4.46	37.32 ± 4.14	38.24 ± 3.33	**2.13***	**(0.48, 3.78)**
Osteoarthritis	1.45 ± 0.71	1.45 ± 0.89	2.24 ± 1.12	2.81 ± 1.09	**1.36*****	**(0.95, 1.76)**
SF-12 Score						
Physical	27.40 ± 5.18	49.59 ± 7.83	—	37.69 ± 10.48	**10.30*****	**(6.65, 13.94)**
Mental	44.76 ± 14.32	55.67 ± 9.72	—	44.38 ± 15.83	**-0.39**	**(-7.04, 6.27)**
Constant-Murley Score						
Pain	0.88 ± 2.16	11.81 ± 4.27	—	8.85 ± 4.02	**7.96*****	**(6.54, 9.39)**
Daily Living	2.55 ± 0.89	16.50 ± 4.88	—	15.69 ± 5.45	**13.14*****	**(11.42, 14.86)**
Range of Motion	10.86 ± 5.41	33.00 ± 7.72	—	27.81 ± 9.54	**16.95*****	**(13.53, 20.37)**
Strength	12.88 ± 5.86	27.40 ± 12.96	—	19.28 ± 12.05	**6.40****	**(2.22, 10.57)**
Total	26.50 ± 7.71	74.07 ± 18.27	—	68.69 ± 23.35	**42.19*****	**(34.53, 49.85)**

Data are presented as Mean ± Standard Deviation (Range) or Mean (CI). CI = 95% confidence interval; SF-12, 12-Item Short Form Health Survey. *p<0.05, **p<0.01, ***p<0.001 by paired t-test. "—" indicates that this data at this time point was recorded.

Table 2. Patient-reported satisfaction	2019 Follow Up	2023 Follow Up
Implant Survival	83.33% (35)	83.33% (35)
All 42 Patients		
Follow Up Time, months	37.62 ± 10.84 (24, 56)	83.98 ± 9.50 (64, 102)
Excellent Satisfaction	61.90% (26)	9.52% (4)
Satisfied	16.67% (7)	47.62% (20)
Dissatisfied	21.43% (9)	42.86% (18)
35 Patients with Implant Survival at 2023 Follow Up		
Follow Up Time, months	37.14 ± 11.31 (24, 56)	83.83 ± 10.26 (64, 102)
Excellent Satisfaction	74.29% (26)	11.43% (4)
Satisfied	20.00% (7)	57.14% (20)
Dissatisfied	5.71% (2)	31.43% (11)

Figure 1. Implant Survival Analysis