Subacromial Balloon Spacer Versus Partial Rotator Cuff Repair in Treatment of Massive Irreparable Rotator Cuff Tears: Facility Personnel Allocation and Procedural Cost Analysis

Tyler Luthringer[1], Alexander Rondon, Alayna Vaughan[2], Adam Khan[3], Joseph A Abboud[2]
[1]Rothman Institute, [2]Rothman Orthopaedic Institute, [3]Rothman Institute/Thomas Jefferson University

INTRODUCTION:

Massive irreparable rotator cuff tears pose a significant treatment challenge, with a variety of treatment options described in the literature. The subacromial balloon spacer is a novel technology that has shown early promise in managing irreparable rotator cuff tears with potential for being more cost-effective than other available treatment options. No prior study has investigated or compared procedural cost differences in personnel allocation between different treatment options for massive, irreparable rotator cuff tears. The purpose of this study was to quantify the true facility cost difference between patients treated with partial rotator cuff repair (PCR) compared to subacromial balloon spacer (SBS) placement.

METHODS:

A prospective cohort of patients with massive irreparable rotator cuff tears (>5cm) randomized to partial rotator cuff repair versus subacromial balloon spacer between 2015-2018 was retrospectively reviewed. All surgeries were performed by a fellowship-trained surgeon at a single surgical site. Demographic variables, medical comorbidities, and short-term active range-of-motion (ROM) outcomes for all patients were recorded. True facility costs with respect to personnel were calculated using a time-driven activity based-costing (TDABC) algorithm and were classified into personnel costs and supply costs. Time-care intervals were defined as follows; T1: time preoperative area to in the operating room (OR); T2: time in OR to wound closing; T3: time wound closing to out of OR; T4: time out of OR to discharge from post-anesthesia care unit (PACU). Two patients in the PCR cohort were excluded due to incomplete data.

RESULTS:

Seven patients were treated with PCR compared to nine treated with SBS. No significant differences were observed with respect to age, gender, body mass index, comorbidity profiles, or preoperative ROM [Table 1]. Mean follow-up was 16.8 and 22.2 months for PCR and SBS groups, respectively. Between PCR and SBS, no differences were observed in forward elevation (114 vs. 122 degrees, $p=0.684$) or abduction (74 vs. 77 degrees, $p=0.832$) at final follow-up; however, external rotation was significantly higher among SBS patients (8 vs. 37 degrees, $p=0.023$). Implants accounted for the highest proportion of costs for the SBS in comparison to PCR ($6500.00 versus $944.00). However, PCR was associated with an additional disposable equipment costs of $220.00 relative to SBS. Personnel time and costs differences while in the operating room (OR) were significantly less for the SBS ($605.58+/- $144.86) compared to PCR ($1362.76 +/- $112.40) ($p<0.001$). The total mean true facility cost was $7658.00 +/- $343.00 for SBS versus $3429.00 +/- $476.00 for PCR ($p<0.001$).

DISCUSSION AND CONCLUSION:

Implant costs account for over 80% of true facility costs following SBS and over 25% for PCR in treatment of massive, irreparable rotator cuff tears. Despite this difference in implant cost, a substantial reduction in personnel costs were seen with use of SBS, primarily due to reduced time in the operating room. Additionally, disposable costs are lower with the SBS as limited additional equipment is necessary for the procedure. As this novel technology is used more ubiquitously and its price is negotiated down, the cost savings seen in personnel and operating room time will become more significant. Future prospective cost-analyses should also account for potential anesthesia cost-savings associated the SBS placement, as this procedure generally does not require regional nerve block at our institution.

Table 1: Demographic and range-of-motion outcome data: partial rotator cuff repair (PCR) versus subacromial balloon spacer (SBS) cohorts

Demographics	***PCR***	***SBS***	***P value***
n	7	9	
Age (years)	67.1 (9.1)	65.1 (6.6)	0.612
Gender	3 (42.8%)	5 (55.5%)	0.642
BMI (kg/m^2)	28.9 (7.6)	28.7 (5.3)	0.944
CCI	0.57 (0.79)	0.33 (0.50)	0.472
LOS (days)	0.14	0	0.271
Range of Motion	***PCR***	***SBS***	***P value***
FE - Preop	111.4 (28.5)	97.5 (48.6)	0.520
FE - Postop	114.3 (30.3)	121.7 (38.5)	0.684
Abd - Preop	77.1 (21.4)	58.1 (25.1)	0.141
Abd - Postop	74 (20.4)	77 (22.8)	0.832
ER - Preop	30.8 (20.8)	28.1 (12.5)	0.766
ER - Postop	**8.0 (17.9)**	**36.9 (20.0)**	**0.023**

Table 2: Detailed breakdown of partial rotator cuff repair (PCR) versus subacromial balloon spacer (SBS) cohorts - perioperative timeline and cost associated.

Supply Usage	***PCR***	***SBS***	
Supply Count	3.2 anchors	1 balloon	
Supply Cost	$944.00	$6500.00	
Disposables Count	1 cannula 1 burr	- -	
Disposables Cost	$70.00 $150.00	- -	
Time Interval	***PCR***	***SBS***	***P value***
T1 Time	201.3 (101.4)	117.9 (58.5)	0.057
T2 Time	**231.3 (19.1)**	**102.8 (24.6)**	**<0.001**
T3 Time	11.1 (4.3)	9.1 (3.1)	0.292
T4 Time	74.3 (25.9)	60.1 (15.6)	0.194
Total Time	**518 (128.5)**	**289.9 (75.8)**	**<0.001**
TDABC	***PCR***	***SBS***	***P value***
T1 Cost	$797.61 ($401.84)	$467.14 ($232.00)	0.057
T2 Cost	**$1362.76 ($112.40)**	**$605.58 ($144.86)**	**<0.001**
T3 Cost	$58.08 ($22.61)	$47.49 ($16.16)	0.292
T4 Cost	$46.74 ($16.28)	$37.82 ($9.79)	0.194
Total Cost	**$2265.20 ($476.04)**	**$1158.04 ($343.53)**	**<0.001**

T1: time preoperative area to in the OR, T2: time in OR to closing, T3: time closing to out of OR, T4: time out of OR to discharge from PACU