Does Morbid Obesity Negatively Impact Perioperative Outcomes Following Elective Reverse Shoulder Arthroplasty?: A Propensity-Matched Comparative Study

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INTRODUCTION:

The incidence of primary reverse total shoulder arthroplasty (rTSA) and the prevalence of obesity have increased in the United States. Despite this, the literature assessing the effect of morbid obesity (body mass index (BMI)≥40 kg/m^2) on perioperative surgical outcomes remains inconsistent.

Therefore, the purpose of the current study was to: 1) define the baseline demographic differences between morbidly obese patients undergoing primary rTSA from non-morbidly obese patients; 2) identify the reasons for 90-day postoperative ED return and readmission; and 3) investigate the effect of morbid obesity on operative duration, ITBVL, need for transfusion, hospital LOS, perioperative medical and surgical complications, discharge disposition, 90-day return to ED and unplanned 90-day readmission in patients undergoing primary elective rTSA using a consistent short-stem implant. Our hypothesis was that morbidly obese patients would exhibit prolonged surgical duration, higher blood loss, and longer hospital stay compared to non-morbidly obese patients.

METHODS: A retrospective review of consecutive elective primary rTSA cases from January 2016 through September 2023 at a single tertiary referral center was performed. All cases involved a short-stem humeral component and screw-in glenoid baseplate from the same implant manufacturer. Surgical and patient demographic data were collected. Morbidly obese patients were propensity matched at least 1:1 with non-morbidly obese patients based on age, gender, mFI-5 score, age-adjusted Charleson Comorbidity Index (ACCI) score, and 12-month preoperative ED visit. Regression analysis was utilized to assess the relationship between morbid obesity and operative time, LOS, ITVBL, surgical postoperative complications, in-hospital medical complications, disposition, and 90-day ED return and readmission.

RESULTS:

There were 175 total cases included in this study, with 19 (10.9%) morbidly obese patients with a median age of 68 (IQR 64,73) years and a range from 58 to 81 years. The remaining 156 non-morbidly obese patients had a median age of 71 (IQR 66.5,77) years **[Table 1]**.

Following propensity score matching, a group of 41 case-matched controls with a median age of 69 (IQR 65.5,75) years with a range from 56 to 81 years was identified. There were 37 (90%) females with 14 (34%) having an mFI-5<2 **[Table 2]**. There was no statistically significant difference between the propensity matched cohorts with regards to self-identified race, insurance status, ACCI, distance from home-to-clinic, clinical diagnosis, smoking status or a history of a prior ipsilateral shoulder surgery. There was no significant difference with regards to the use of bone cement for humeral component fixation between the two groups (*P=0.15)*. With regards to surgical implants, an augmented glenoid baseplate was used in 3 (16%) of the morbidly obese patients and 14 (34%) of the non-morbidly obese patients (*P=0.22*). A median of 3 peripheral screws were used in both groups (*P=0.24*).

With regards to outcome differences between the matched cohorts, there was no significant difference between the non-morbidly obese and morbidly obese cohorts with regards to median ITBVL (218.6 ml vs. 213.9 ml, *P=0.620*), median hospital stay (2 days vs. 2 days, *P=0.654*), operative time (114 min vs. 114 min, *P=0.423*), 90-day return to ED (21% vs. 19%, *P=0.890*), in-hospital medical complication (24% vs. 21%, *P=0.888*), and disposition to non-home (8% vs. 19%, *P=0.281*) **[Table 3]**.

DISCUSSION AND CONCLUSION:

The main findings from the current study were that patients with morbid obesity undergoing elective rTSA using a single implant design did not demonstrate a longer hospital LOS, operative time, increased in-hospital medical complications, increased risk for transfusion, increased disposition to non-home, increased risk for 90-day ED return or unplanned 90-day readmission.

These findings suggest that morbid obesity should not be considered an absolute contraindication to the utilization of rTSA, and that rTSA can be performed safely in this patient population using a standardized surgical technique following medical optimization. Further research involving patients with higher categories of obesity (BMI≥50 kg/m^2) may shed more light into the true effect of increasing BMI on complications and outcomes following rTSA.

Table 1 Overall patient cohort baseline demographic data

Clinical Parameters	BMI≥40 kg/m2 (median (IQR)) (n=19)	BMI<40 kg/m2 (median(IQR)) (n=156)	p-value
Age, yrs	68 (64,73)	71 (66.5,77)	0.12
Gender, n (%)			0.32
Male	3 (16%)	41 (26%)	
Female	16 (84%)	115 (74%)	
Self-identified Race			
White	5 (28%)	22 (14%)	0.51
Hispanic	10 (50%)	85 (54%)	
Black	4 (22%)	46 (20%)	
Asian	0	3 (2%)	
Insurance type			
Medicare	15 (78%)	122 (78%)	0.60
Medicaid	2 (11%)	25 (16%)	
Commercial	2 (11%)	9 (6%)	
BMI, kg/m^2	42.4 (41.0,45.1)	30.3 (27.2,33.1)	*<0.00001*
Surgical side			0.68
Right	11 (58%)	98 (63%)	
Left	8 (42%)	58 (37%)	
Distance from home-to-clinic	2.6 (1.3,3.0)	3.0 (2.4,4.3)	0.07
Diagnosis			
RTC-deficient arthritis	12 (63%)	54 (35%)	*0.03*
GH OA	4 (21%)	23 (15%)	
Chronic RTC tear	2 (11%)	47 (30%)	
Other	1 (5%)	32 (20%)	
mFI-5			
0,1	8 (42%)	76 (49%)	0.59
≥2	11 (58%)	80 (51%)	
Smoking status			
Never	6 (32%)	87 (56%)	0.10
Former	11 (58%)	53 (34%)	
Current	2 (10%)	16 (10%)	
Age-adjusted Charleson Comorbidity Index (ACCI)	4 (3,5)	4 (3,5)	0.88
Prior ipsilateral surgery			0.85
None	16 (84%)	112 (72%)	
Arthroscopy	3 (16%)	35 (22%)	
Open surgery	0 (0%)	5 (3%)	
Open surgery/arthroscopy	0 (0%)	4 (3%)	

IQR: inter-quartile range; BMI: body mass index; mFI-5:5-item modified fragility index; ACCI: Age-adjusted Charleson Comorbidity Index; GH OA: glenohumeral osteoarthritis; RTC: rotator cuff

Table 2 Demographic data following propensity score case matching

Clinical Parameters	BMI≥40 kg/m2 (median (IQR)) (n=19)	BMI<40 kg/m2 (median(IQR)) (n=41)	p-value
Age, yrs	68 (64,73)	68 (65,73)	0.80
Gender, n (%)			0.50
Male	3 (16%)	4 (10%)	
Female	16 (84%)	37 (90%)	
Self-identified Race			0.35
White	5 (28%)	6 (15%)	
Hispanic	10 (50%)	20 (49%)	
Black	4 (22%)	15 (37%)	
Asian	0	0 (0%)	
Insurance type			0.33
Medicare	15 (78%)	32 (78%)	
Medicaid	2 (11%)	8 (20%)	
Commercial	2 (11%)	1 (2%)	
BMI, kg/m^2	42.4 (41.0,45.1)	30.6 (26.4,32.7)	*<0.00001*
Surgical side			0.90
Right	11 (58%)	23 (56%)	
Left	8 (42%)	18 (44%)	
Distance from home-to-clinic	2.6 (1.3,3.0)	2.8 (2.4,3.7)	0.19
Diagnosis			0.16
RTC-deficient arthritis	12 (63%)	16 (39%)	
GH OA	4 (21%)	6 (15%)	
Chronic RTC tear	2 (11%)	10 (24%)	
Other	1 (5%)	9 (22%)	
mFI-5			0.55
0,1	8 (42%)	14 (34%)	
≥2	11 (58%)	27 (56%)	
Smoking status			0.19
Never	6 (32%)	23 (56%)	
Former	11 (58%)	14 (34%)	
Current	2 (10%)	4 (10%)	
Age-adjusted Charleson Comorbidity Index (ACCI)	4 (3,5)	4 (3,6)	0.75
Prior ipsilateral surgery			0.25
None	16 (84%)	24 (59%)	
Arthroscopy	3 (16%)	12 (29%)	
Open surgery	0 (0%)	3 (7%)	
Open surgery/arthroscopy	0 (0%)	2 (5%)	

IQR: inter-quartile range; BMI: body mass index; mFI-5:5-item modified fragility index; ACCI: Age-adjusted Charleson Comorbidity Index; GH OA: glenohumeral osteoarthritis; RTC: rotator cuff

Table 3: Comparison of outcomes between matched cohorts

	Non-morbid obese (BMI < 40) N = 41	Morbid obese (BMI ≥ 40) N = 19	Not morbid obese – morbid obese (within pair difference)	P value
ITBVL, median (IQR)	218.6 (139.8, 305.0)	213.9 (106.3, 434.5)	7.0 (-127.7, 114.1)	0.620
Hospital stay, median (IQR)	2 (2, 3)	2 (1, 3)	0 (-1, 1)	0.654
Operative time, median (IQR)	114 (96, 126)	114 (103, 137)	0 (-35, 22)	0.423
90-day return to ED *No* *Yes*	 34 7	 16 3		0.890
Intraoperative complications *No* *Yes*	 41 0	 17 2		n/a
Surgical postoperative complications *No* *Yes*	 38 3	 19 0		n/a
In-hospital medical complication *No* *Yes*	 33 8	 15 4		0.888
90-day readmission *No* *Yes*	 35 6	 18 1		0.321
Disposition *Home* *Non-home*	 38 3	 16 3		0.281
Transfusion *No* *Yes*	 39 2	 18 1		0.950

IQR: inter-quartile range; ED: Emergency Department