Does Obesity Influence Outcomes of Primary, Single-Level Lateral Lumbar Interbody Fusion?

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INTRODUCTION:

The influence of obesity on outcomes of lateral lumbar interbody fusion (LLIF) has not been extensively evaluated. We aim to determine if obesity impacts perioperative characteristics, patient-reported outcome measures (PROMs), or minimal clinically important difference (MCID) achievement following primary, single-level LLIF.

METHODS:

Patients undergoing primary, single-level LLIF were identified from a single-surgeon retrospective database. Subjects missing body mass index (BMI) and subjects undergoing LLIF for infection, cancer, or trauma were excluded. Patients were divided into Non-Obese (BMI <30 kg/m^2) and Obese (BMI ≥30 kg/m^2) groups. Demographic and perioperative characteristics were collected and compared between groups. PROM scores were collected in the preoperative period and postoperative period at 6-weeks, 12-weeks, 6-months, and 1-year. The following PROMs were evaluated in this study: Visual Analog Scale (VAS) back and leg, Oswestry Disability Index (ODI), 12-Item Short Form (SF-12) Physical Composite Score (PCS), and Patient-Reported Outcome Measurement Information System physical function (PROMIS-PF). PROMs were compared within groups to preoperative baseline scores and between groups at each time point. MCID achievement was determined using established threshold values for change in PROMs from preoperative to each postoperative time point and compared between groups.

RESULTS:

A total of 88 patients were included in the final study, with 54 non-obese and 34 obese subjects. Age, gender, ethnicity, diabetic status, smoking status, hypertensive status, American Society of Anesthesiologists (ASA) classification, Charlson Comorbidity Index (CCI) score, and insurance did not significantly differ between groups. The majority of patients presented with degenerative spondylolisthesis (59.1%). Central stenosis was present in 89.8% (n=79) patients, while foraminal stenosis present in 58.0% (n=51). Length of stay on average was longer in the obese cohort (43.8 hours vs 33.0 hours; p=0.037). Mean narcotic consumption at postoperative day 1 was also higher in the obese cohort (47.6 oral morphine equivalents [OME] vs. 29.2 OME; p=0.044). Other perioperative characteristics and 1-year arthrodesis rate (100.0% for both groups) did not significantly differ. The non-obese group improved from preoperative to postoperative PROM values at all time points (p≤0.018, all) except for PROMIS-PF and SF-12 PCS at 6-weeks. The obese group improved from preoperative to postoperative PROM values at all time points (p≤0.047, all) apart from PROMIS-PF (6-weeks through 1-year), SF-12 PCS at 6 weeks, and ODI at 1-year. Mean PROMIS-PF was significantly higher in the non-obese group at 12-weeks and 6-months, and mean disability was significantly higher in the obese group at 1-year following LLIF (p≤0.046, all). MCID achievement rates significantly differed for ODI at 12-weeks and 1-year, and for PROMIS-PF at 6-months, only (p≤0.024, all).

DISCUSSION AND CONCLUSION: Obese patients required longer postoperative stay and greater amounts of narcotics following single-level LLIF. Obese patients also suffered from poorer PROMIS-PF scores in the intermediate postoperative period; however, SF-12 PCS scores were similar. Additionally, apart from higher disability for this group at 1-year, all other disability scores were similar. Back and leg pain scores also did not differ. MCID achievement rates were generally comparable between both groups for pain, disability, and physical function.

Table 1. Patient Demographics

Characteristic	Total (n=88)	Non-Obese (n=54)	Obese (n=34)	*p-value
Age (mean ± SD, years)	57.3±12.4	57.7±13.6	56.7±10.4	0.709
Gender				0.544
Female	48.9% (43)	46.3% (25)	52.9% (18)	
Male	51.1% (45)	53.7% (29)	47.1% (16)	
Ethnicity				0.063
Caucasian	78.2% (16)	84.9% (45)	67.7% (23)	
African American	6.9% (6)	3.8% (2)	11.8% (4)	
Hispanic	6.9% (6)	1.9% (1)	14.7% (5)	
Asian	2.3% (2)	3.8% (2)	0.0% (0)	
Other	5.8% (5)	5.7% (3)	5.9% (2)	
Diabetic Status				0.554
Non-Diabetic	93.2% (82)	94.4% (51)	91.2% (31)	
Diabetic	6.8% (6)	5.6% (3)	8.8% (3)	
Smoking Status				0.616
Non-Smoker	82.8% (72)	81.1% (43)	85.3% (29)	
Smoker	17.2% (15)	18.9% (10)	14.7% (5)	
Hypertension Status				0.456
Non-hypertensive	63.6% (56)	66.7% (36)	58.8% (20)	
Hypertensive	36.4% (32)	33.3% (18)	41.2% (14)	
ASA Classification				0.351
<2	11.4% (10)	13.0% (7)	8.8% (3)	
≥2	88.6% (78)	87.0% (47)	91.2% (31)	
CCI Score (Mean ± SD)	2.5±2.1	2.5±2.3	2.5±1.7	0.899
Insurance				0.240
Medicare/Medicaid	13.6% (12)	13.0% (7)	14.7% (5)	
Workers' Compensation	18.2% (16)	13.0% (7)	26.5% (9)	
Private	68.2% (60)	74.1% (40)	58.8% (20)	

ASA = American Society of Anesthesiologists; CCI = Charlson Comorbidity Index; SD= standard deviation
Boldface indicates significance

Table 2. Perioperative Characteristics

Characteristic	Total (n=88)	Non-Obese (n=54)	Obese (n=34)	*p-value
Spinal Pathology				
Degenerative Spondylolisthesis	59.1% (52)	61.1% (33)	55.9% (19)	0.627
Isthmic Spondylolisthesis	18.2% (16)	14.8% (8)	23.5% (8)	0.302
Recurrent Herniated Nucleus Pulposus	3.4% (3)	1.9% (1)	5.9% (2)	0.310
Degenerative Scoliosis	26.1% (23)	29.6% (16)	20.6% (7)	0.347
Central Stenosis	89.8% (79)	88.9% (48)	91.2% (31)	0.730
Foraminal Stenosis	58.0% (51)	64.8% (35)	47.1% (16)	0.100
Operative Time (Mean ± SD; min)	122.0±50.4	115.8±50.0	132.1±50.1	0.145
Estimated Blood Loss (Mean ± SD; mL)	50.3±25.2	49.5±24.5	51.5±26.5	0.723
Length of Stay (Mean ± SD; hours)	37.3±22.1	33.0±20.8	43.8±22.6	**0.037**
Postoperative Vas pain				
POD 0	5.1±2.1	5.1±2.1	5.1±2.1	0.905
POD 1	4.6±1.7	4.6±1.6	4.8±1.9	0.720
Postoperative Narcotic Consumption (OME)				
POD 0	57.8±42.2	57.9±48.1	57.6±31.4	0.973
POD 1	36.3±41.8	29.2±44.1	47.6±35.6	**0.044**
1-year Arthrodesis	100.0% (38)	100.0% (23)	100.0% (15)	-

POD = postoperative day; mL = milliliters; OME = oral morphine equivalents; SD= standard deviation
*p-values calculated using Student's t-test for continuous variables and chi-square analysis for categorical variables
Boldface indicates significance

Table 3. Mean Patient Reported Outcomes

PROM	Non-Obese Mean ± SD	*p-value	Obese Mean ± SD	†p-value	**p-value
PROMIS PF					
Preoperative	36.7±7.5	-	35.6±7.9	-	0.676
6-weeks	39.1±6.0	0.179	37.3±4.5	0.780	0.377
12-weeks	43.7±2.9	**0.002**	38.8±5.7	0.130	**0.046**
6-months	49.7±7.2	**<0.001**	41.7±8.5	0.297	**0.031**
1-year	48.4±6.7	**<0.001**	45.0±9.6	0.064	0.332
SF-12 PCS					
Preoperative	32.0±8.1	-	30.2±9.1	-	0.502
6-weeks	33.0±9.8	0.223	32.3±9.6	0.392	0.827
12-weeks	40.0±10.3	**<0.001**	38.2±12.9	**0.010**	0.689
6-months	45.5±12.6	**0.001**	41.6±13.9	**0.003**	0.519
1-year	43.7±11.7	**0.004**	42.4±15.2	**0.009**	0.838
VAS back					
Preoperative	6.3±2.0	-	6.9±2.3	-	0.220
6-weeks	3.3±2.3	**<0.001**	3.2±2.2	**<0.001**	0.980
12-weeks	2.5±2.5	**<0.001**	3.3±2.4	**<0.001**	0.260
6-months	2.0±2.4	**<0.001**	3.4±3.1	**0.013**	0.156
1-year	2.1±2.7	**0.018**	3.6±1.4	**0.043**	0.180
VAS leg					
Preoperative	5.4±2.5	-	5.5±3.4	-	0.937
6-weeks	2.3±1.8	**<0.001**	2.3±2.6	**0.002**	0.974
12-weeks	1.4±1.9	**<0.001**	1.8±2.7	**0.007**	0.588
6-months	1.2±1.9	**<0.001**	2.5±3.2	**0.047**	0.257
1-year	1.9±2.8	**0.002**	2.1±1.4	**0.012**	0.881
ODI					
Preoperative	32.5±11.6	-	39.4±18.2	-	0.098
6-weeks	26.0±13.0	**0.032**	34.3±14.3	**0.023**	0.059
12-weeks	22.2±15.3	**0.001**	19.1±20.8	**0.005**	0.614
6-months	15.1±11.5	**<0.001**	20.2±18.6	**0.008**	0.389
1-year	13.1±11.1	**0.001**	39.7±21.4	0.532	**0.001**

*p-values calculated using paired sample t-test to determine preoperative to postoperative improvement in non-Obese cohort
†p-values calculated using paired samples t-test to determine preoperative to postoperative improvement in Obese cohort
**p-values calculated using Student's t-test for independent samples to compare mean PROMs between both cohorts
Boldface indicates significance

Table 4. Minimum Clinically Important Difference

PROM	Non-Obese %, (n)	Obese %, (n)	*p-value
ODI			
6-weeks	32.0% (8)	31.3% (5)	0.960
12-weeks	32.0% (8)	72.7% (8)	**0.023**
6-months	63.2% (12)	80.0% (4)	0.477
1-year	53.9% (7)	0.0% (0)	**0.024**
Overall	61.3% (19)	61.1% (11)	0.990
PROMIS-PF			
6-weeks	35.0% (7)	33.3% (3)	0.930
12-weeks	62.5% (10)	42.9% (3)	0.382
6-months	86.7% (13)	33.3% (2)	**0.015**
1-year	81.8% (9)	57.1% (4)	0.255
Overall	79.2% (19)	60.0% (6)	0.248
SF-12 PCS			
6-weeks	45.0% (9)	66.7% (8)	0.234
12-weeks	72.2% (13)	77.8% (7)	0.756
6-months	83.3% (10)	100.0% (7)	0.253
1-year	72.7% (8)	85.7% (6)	0.518
Overall	75.0% (18)	92.3% (12)	0.199
VAS back			
6-weeks	53.9% (21)	68.0% (17)	0.261
12-weeks	69.2% (27)	67.4% (11)	0.739
6-months	67.9% (19)	66.7% (6)	0.947
1-year	61.5% (8)	66.7% (4)	0.829
Overall	76.1% (35)	74.1% (20)	0.847
VAS leg			
6-weeks	44.0% (11)	68.8% (11)	0.121
12-weeks	60.0% (15)	70.0% (7)	0.580
6-months	77.8% (14)	60.0% (3)	0.423
1-year	76.9% (10)	83.3% (5)	0.750
Overall	74.2% (23)	72.2% (13)	0.880

*p-values calculated using chi-square analysis
Boldface indicates significance