

Obesity Is Associated with High Perioperative Complications Among Surgically Treated Intertrochanteric Fractures of the Femur

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Background/Purpose: The purpose of this study was to evaluate the hypothesis that obese patients undergoing surgical fixation for intertrochanteric fracture of the femur have more perioperative complications in comparison to nonobese patients. These data could help orthopaedic surgeons formulate necessary guidelines in managing hip fractures in obese individuals and to provide necessary counseling to the patients and their families. In addition this analysis may be critically important in determining hospital reimbursement for this patients.

Methods: A retrospective review at two academic Level I trauma centers was conducted to identify all skeletally mature patients who underwent surgical fixation of intertrochanteric fractures between June 2008 and December 2014. Descriptive data, mode of injury characteristics, OTA fracture classification, and associated medical comorbidities were documented. Patients were stratified into two groups based on the body mass index (BMI): nonobese group included those with a BMI of $<29.9 \text{ kg/m}^2$ and obese group included those with a BMI of $\geq 30 \text{ kg/m}^2$. The outcomes measured included in-hospital complications, length of stay, rate of blood transfusion, and fall in hemoglobin levels, operative time, and wound infection.

Results: In this study, 212 of 835 patients (25%) who were treated for intertrochanteric fracture of the femur had a BMI of 30 or greater. Patients with a high BMI (≥ 30) had a significantly lower mean age (74 vs 77 years, $P = 0.01$) than patients with a BMI <30 , were more likely to have a high-energy injury (16% vs 10%, $P = 0.03$), were more likely to be diabetic (32% vs 23%, $P = 0.005$), and were more likely to have cardiac diseases (59% vs 48%, $P = 0.0007$). The mean duration of surgery was also greater for patients with high BMI (96 vs 86 minutes, $P = 0.04$), the mean estimated blood loss was higher (184 vs 118 mL, $P < 0.0001$), and the mean length of hospital stay was higher (6.3 vs 5.5 days, $P < 0.0001$). The group of patients with a high BMI had a significantly higher mean hemoglobin value prior to surgery (12.1 vs 11.8, $P = 0.02$) and showed a significantly larger change in hemoglobin after versus before surgery (-2.7 vs -2.3 units, $P = 0.002$) (Table 1A). The high BMI group had significantly higher percentages of patients with every complication examined (P values < 0.05), with the exception of pulmonary embolism, deep vein thrombosis, wound infection/discharge, sepsis, and inpatient death. In order to eliminate the possibility that these results were being confounded by different rates of high-energy falls and diabetes in the high BMI group, however, we performed an additional analysis: we removed the patients with high-energy fractures from the cohort, and stratified the remaining low-energy trauma patients by whether or not they had diabetes. In the nondiabetic group ($n = 541$ patients total), the group with BMI ≥ 30 had significantly higher rates of overall ("any"), cardiac, and respiratory complications, acute

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anemia, and electrolyte complications, but not the remaining complications. In the diabetic group, only the overall rate of complications (“any”) and “other” complications showed a statistically significant difference between the low- and high-BMI groups (Tables 2A and 3A).

Conclusion: Obese patients are more likely to have had a high-energy fracture and are more likely to be diabetic than similar patients with a BMI of less than 30. However, within the subgroup of patients who had low-energy injuries and no diabetes, patients with BMI ≥ 30 were still more likely than patients with BMI < 30 to experience many types of short-term complications including cardiac complications, respiratory complications, acute anemia, and electrolyte abnormalities. Institutions are scrutinized for increasing cost of care especially for hip fractures and the Centers for Medicare & Medicaid Services may need to consider higher complications among the obese patients while setting reimbursement levels.

Table 1A. Baseline and surgical characteristics, stratified by BMI group (<30 vs. ≥30).

	BMI <30 (n=623)	BMI ≥30 (n=212)	p-value
BMI category, N (%)			--
0.0-24.9	394 (63%)	--	
25.0-29.9	229 (37%)	--	
30.0-34.9	--	139 (66%)	
35.0-39.9	--	38 (18%)	
40.0 and above	--	35 (17%)	
Males, N (%)	216 (35%)	74 (35%)	0.95
Age in years, Mean (SD)	77 (15)	74 (14)	0.01
Method of injury, N (%)			0.05
Fall	565 (91%)	189 (89%)	
Motorcycle crash	2 (<1%)	4 (2%)	
Motor vehicle crash	14 (2%)	10 (5%)	
Pathologic	5 (<1%)	1 (<1%)	
Twist	2 (<1%)	0 (0%)	
Other			
Energy of injury, N (%)			0.03
Low	560 (90%)	178 (84%)	
High	63 (10%)	34 (16%)	
OTA classification, N (%)*			0.07
31A11	214 (35%)	55 (26%)	
31A12	79 (13%)	29 (14%)	
31A13	0 (0%)	0 (0%)	
31A21	143 (23%)	40 (19%)	
31A22	44 (7%)	16 (8%)	
31A23	29 (5%)	12 (6%)	
31A31	59 (10%)	27 (13%)	
31A32	23 (4%)	14 (7%)	
31A33	27 (4%)	16 (8%)	
Comorbidities			
Diabetes, N (%)	140 (23%)	68 (32%)	0.005
CVS, N (%)	300 (48%)	125 (59%)	0.007
Arrhythmia, N (%)	116 (19%)	47 (22%)	0.26
Pulmonary disease, N (%)	102 (16%)	33 (16%)	0.78
Renal disease, N (%)	89 (14%)	36 (17%)	0.35
CVA/stroke, N (%)	58 (9%)	23 (11%)	0.52
Hypothyroidism, N (%)	108 (17%)	34 (16%)	0.66
Surgical characteristics			
ASA Score, N (%)			0.94
1	14 (2%)	4 (2%)	
2	141 (23%)	50 (24%)	
3	389 (64%)	137 (65%)	
4	66 (11%)	20 (9%)	
1 (<1%)	1 (<1%)	0 (0%)	
Days waited until surgery, Mean (range)	2.4 (0, 438)	2.5 (0, 300)	0.44
Duration of surgery in minutes, Mean (SD)	86 (54)	96 (65)	0.04
Estimated blood loss in mL, Mean (SD)**	118 (130)	184 (226)	<0.0001
Length of stay in days, Mean (range)	5.5 (0, 46)	6.3 (1, 51)	<0.0001
Blood units transfused, Mean (range)	0.7 (0, 7)	1.0 (0, 6)	0.0002
Lab values			
Hgb prior to surgery, Mean (SD)	11.8 (1.8)	12.1 (1.6)	0.02
Hgb after surgery, Mean (SD)	9.6 (1.6)	9.4 (1.5)	0.26
Difference in Hgb pre-post, Mean (SD)	2.3 (1.6)	2.7 (1.5)	0.002
INR prior to surgery, Mean (SD)	1.3 (0.5)	1.3 (0.5)	0.87
INR after surgery, Mean (SD)	1.4 (0.4)	1.5 (1.4)	0.39

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Table 2A. Perioperative and postoperative complication rates.*

	BMI <30 (n=623)	BMI ≥30 (n=212)	p-value
Perioperative complications, any, N (%)	116 (19%)	93 (45%)	<0.0001
Cardiac complications, N (%)	29 (5%)	18 (9%)	0.03
Respiratory complications, N (%)	24 (4%)	25 (12%)	<0.0001
Pulmonary embolism, N (%)	3 (<1%)	3 (1%)	0.05
Acute renal failure, N (%)	15 (2%)	11 (5%)	0.04
Acute anemia, N (%)	56 (9%)	29 (14%)	0.04
Electrolyte abnormalities, N (%)	11 (2%)	11 (5%)	0.006
Deep vein thrombosis (DVT), N (%)	3 (<1%)	4 (2%)	0.07
Wound infection/discharge, N (%)	9 (1%)	6 (3%)	0.22
Sepsis, N (%)	10 (2%)	8 (4%)	0.09
Other complications	16 (3%)	12 (6%)	0.03
Inpatient deaths, N (%)	17 (3%)	7 (3%)	0.67

*Complications were not recorded for 13 patients.

Table 3A. Perioperative and postoperative complication rates for low-energy injuries only, stratified by Diabetes and BMI group.

	No Diabetes			Diabetes		
	BMI <30 (n=427)	BMI ≥30 (n=114)	p-value	BMI <30 (n=133)	BMI ≥30 (n=64)	p-value
Perioperative complications, any, N (%)	74 (17%)	53 (48%)	<0.0001	31 (23%)	27 (43%)	0.005
Cardiac complications, N (%)	18 (4%)	13 (12%)	0.003	8 (6%)	3 (5%)	0.99
Respiratory complications, N (%)	18 (4%)	15 (14%)	0.0003	4 (3%)	5 (8%)	0.15
Pulmonary embolism, N (%)	1 (<1%)	1 (<1%)	0.37	0 (0%)	1 (2%)	0.32
Acute renal failure, N (%)	7 (2%)	4 (4%)	0.20	6 (5%)	7 (11%)	0.12
Acute anemia, N (%)	34 (8%)	18 (16%)	0.009	16 (12%)	10 (16%)	0.50
Electrolyte abnormalities, N (%)	4 (1%)	7 (6%)	0.002	7 (5%)	3 (5%)	0.99
Deep vein thrombosis (DVT), N (%)	2 (<1%)	2 (2%)	0.20	0 (0%)	2 (3%)	0.10
Wound infection/discharge, N (%)	4 (1%)	3 (3%)	0.16	4 (3%)	1 (2%)	0.99
Sepsis, N (%)	5 (1%)	4 (4%)	0.10	4 (3%)	3 (5%)	0.68
Other complications	12 (3%)	3 (3%)	0.99	3 (2%)	6 (9%)	0.06
Inpatient deaths, N (%)	13 (3%)	4 (4%)	0.77	3 (2%)	2 (3%)	0.66