General Anesthesia Versus Spinal Anesthesia in Intertrochanteric Femur Fracture Treatments: An ACS NSQIP Analysis 2008-2016

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INTRODUCTION: Intertrochanteric fractures are common amongst the elderly, and typically result from ground-level falls. Because the majority of elderly patients who experience intertrochanteric fractures have more comorbidities, these fractures are associated with increased probabilities of morbidity and mortality. Therefore, it becomes important to determine whether general or spinal anesthesia used during treatment yields better postoperative outcomes.

METHODS: The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database was retrospectively queried between 2008 and 2016 for patients undergoing operative treatment of intertrochanteric fractures with either a sliding hip screw or intramedullary nailing (CPT codes 27244, 27245), and grouped into general and spinal anesthesia cohorts. These groups were 1:1 propensity score matched with respect to estimated probability of morbidity, BMI, age, and gender. Patient demographics, comorbidities, and 30-day post-operative outcomes were collected and analyzed between both groups. Univariate and multivariate logistic regression analysis controlling for age, gender, and probability of morbidity was utilized to determine if general or spinal anesthesia could be considered to be independent risk factors for adverse postoperative outcomes.

RESULTS: 42,468 patients who had operative treatment of an intertrochanteric fracture between 2008 and 2016 were isolated (67.0% general anesthesia, 19.0% spinal anesthesia). 1:1 propensity score matching yielded two groups of 4,045 patients, who have been given either general or spinal anesthesia. Because the majority of patients with intertrochanteric fractures are elderly, it was not unusual to have a mean age of 77.9 years in the aforementioned groups. Within this division, a predominance of females (70.2%) was also expected. Their probability of morbidity was 0.10, and probability of mortality was 0.05. 6,350 (78.5%) patients had an ASA classification of 3 or 4, 5,495 (67.9%) had anemia, 5,279 (65.3%) had hypertension requiring medication, and 1,548 (19.1%) had diabetes. Post-operatively, 3,718 (46.0%) patients experienced adverse events and 3,347 (41.4%) had postoperative complications, with transfusion being the most common (33.3%) (Table 1). As expected, general anesthesia was associated with longer operative times (63.1 v 57.7 min, $p<0.001$) (Table 1). Spinal anesthesia was associated with longer lengths of hospitalization (7.2 v 6.3, $p<0.001$), and individuals elected for this anesthetic technique had lower ASA classifications ($p<0.001$) (Table 1). Patients elected for general anesthesia had greater frequencies of ventilator dependence (0.4% v 0.1%, $p= 0.003$), hypertension which required medication (67.8% v 62.7%, $p<0.001$), bleeding disorders (19.5% v 9.1%, $p<0.001$), and anemia (69.4% v 66.4%, $p= 0.004$) (Table 1). Patients elected for spinal anesthesia had greater frequencies of chronic obstructive pulmonary disease (15.8% v 11.0%, $p<0.001$) (Table 1). Other comorbidities, readmission, reoperation, and mortality rates were similar between both cohorts (all, $p>0.05$) (Table 1). Post-operatively, patients elected for general anesthesia experienced more adverse events (49.5% v 42.4%, $p<0.001$) and complications (44.9% v 37.8%, $p<0.001$), as compared to spinal anesthesia (Table 1). They had greater rates of bleeding requiring transfusion (37.5% v 29.0%, $p<0.001$), more failures to wean off of ventilators (0.8% v 0.4%, $p= 0.015$), more cardiac complications (4.0% v 3.1%, $p= 0.030$), and thrombophlebitis (1.5% v 0.9%, $p= 0.013$) (Table 1). Multivariate logistic regression analysis determined general anesthesia to be an independent predictor for increased risk of adverse events (OR 1.4 [1.2-1.5]; $p< 0.001$), postoperative complications (OR 1.4 [1.2-1.5]; $p<0.001$), wound complications (OR 1.5 [1.4-1.6]; $p< 0.001$), bleeding requiring transfusion (OR 1.5 [1.4-1.6]; $p<0.001$), failure to wean (OR 2.2 [1.2-4.0]; $p= 0.010$), cardiac complications (OR 1.3 [1.0-1.7]; $p= 0.027$), and thrombophlebitis (OR 1.7 [1.1-2.6]; $p= 0.014$) (Table 2).

DISCUSSION AND CONCLUSION: General and spinal anesthetic techniques were found to be most commonly used in operative treatments of intertrochanteric femur fractures. General anesthesia was determined to be an independent predictor for increased risk of adverse events, postoperative complications, wound complications, bleeding requiring transfusion, failure to wean, cardiac complications, and thrombophlebitis, as compared to spinal anesthesia. General anesthesia was not associated with significantly increased rates of readmission, reoperation, or mortality. Given that the majority of patients requiring operative treatment of intertrochanteric femur fractures are already at increased risk for developing post-operative complications, it becomes especially important for surgeons to understand how general anesthesia may increase these risks, as compared to spinal anesthesia.

Postoperative Outcomes	Spinal Anesthesia N (%)	General Anesthesia N (%)	P-value
Adverse Events	1717 (42.4%)	2001 (49.5%)	<0.001
Any Postoperative Complication	1530 (37.8%)	1817 (44.9%)	<0.001
Wound Complications	1186 (29.3%)	1537 (38.0%)	<0.001
Superficial SSI	20 (0.5%)	27 (0.7%)	0.306
Deep SSI	9 (0.2%)	6 (0.1%)	0.438
Wound dehiscence	0 (0.0%)	2 (0.0%)	0.157
Bleeding requiring Transfusion	1172 (29.0%)	1518 (37.5%)	<0.001
Pulmonary Complications	214 (5.3%)	222 (5.5%)	0.694
Pneumonia	163 (4.0%)	158 (3.9%)	0.776
Pulmonary Embolism	36 (0.9%)	28 (0.7%)	0.315
Failure to wean (Ventilator > 48 hours)	16 (0.4%)	33 (0.8%)	0.015
Unplanned Intubation	44 (1.1%)	55 (1.5%)	0.266
Renal Complications	223 (5.5%)	204 (5.0%)	0.345
Progressive Renal Insufficiency	14 (0.3%)	15 (0.4%)	0.852
Acute renal failure	7 (0.2%)	13 (0.3%)	0.179
Urinary tract infection	204 (5.0%)	184 (4.5%)	0.298
Neuro Complications (CVA/Stroke)	25 (0.6%)	28 (0.7%)	0.679
Cardiac Complications	124 (3.1%)	160 (4.0%)	0.030
Cardiac arrest	25 (0.6%)	37 (0.9%)	0.126
Myocardial Infarction	67 (1.7%)	69 (1.7%)	0.863
DVT/Thrombophlebitis	35 (0.9%)	59 (1.5%)	0.013
Sepsis-Related Complications	72 (1.8%)	83 (2.1%)	0.372
Sepsis	47 (1.2%)	50 (1.2%)	0.759
Septic Shock	24 (0.6%)	32 (0.8%)	0.283
Organ/Space SSI	1 (0.0%)	6 (0.1%)	0.059
Readmission	302 (7.5%)	349 (8.6%)	0.055
Reoperation	88 (2.2%)	88 (2.2%)	1.000
Mortality	202 (5.0%)	220 (5.4%)	0.368

Table 1. Rates of Postoperative Outcomes in Intertrochanteric Femur Fracture Treatments done with Spinal or General Anesthesia.

Postoperative Outcomes	Univariate OR (95% CI)	P-value	Multivariate OR (95% CI)	P-value
Adverse Events	1.3 (1.2-1.4)	<0.001	1.4 (1.2-1.5)	<0.001
Any Postoperative Complication	1.3 (1.2-1.5)	<0.001	1.4 (1.2-1.5)	<0.001
Wound Complications	1.5 (1.3-1.6)	<0.001	1.5 (1.4-1.6)	<0.001
Superficial SSI	1.4 (0.8-2.4)	0.308	1.3 (0.7-2.4)	0.325
Deep SSI	0.7 (0.2-1.9)	0.441	0.7 (0.2-1.8)	0.416
Wound dehiscence	-	-	-	-
Bleeding requiring Transfusion	1.5 (1.3-1.6)	<0.001	1.5 (1.4-1.6)	<0.001
Pulmonary Complications	1.0 (0.9-1.3)	0.694	1.1 (0.9-1.3)	0.604
Pneumonia	1.0 (0.8-1.2)	0.776	1.0 (0.8-1.2)	0.873
Pulmonary Embolism	0.8(0.5-1.3)	0.317	0.8 (0.5-1.3)	0.317
Failure to wean (Ventilator > 48 hours)	2.1 (1.1-3.8)	0.017	2.2 (1.2-4.0)	0.010
Unplanned Intubation	1.3 (0.8-1.9)	0.267	1.3 (0.9-1.9)	0.216
Renal Complications	0.9 (0.7-1.1)	0.345	0.9 (0.7-1.1)	0.339
Progressive Renal Insufficiency	1.1 (0.5-2.2)	0.852	1.1 (0.5-2.2)	0.840
Acute renal failure	1.9 (0.7-4.7)	0.186	2.0 (0.8-5.1)	0.140
Urinary tract infection	0.9 (0.7-1.1)	0.298	0.9 (0.7-1.1)	0.288
Neuro Complications (CVA/Stroke)	1.1 (0.7- 1.9)	0.679	1.1 (0.6-1.9)	0.692
Cardiac Complications	1.3 (1.0-1.7)	0.030	1.3 (1.0-1.7)	0.027
Cardiac arrest	1.5 (0.9-2.5)	0.128	1.5 (0.9-2.5)	0.110
Myocardial Infarction	1.0 (0.7-1.4)	0.863	1.0 (0.7-1.5)	0.840
DVT/Thrombophlebitis	1.7 (1.1-2.6)	0.014	1.7 (1.1-2.6)	0.014
Sepsis-Related Complications	1.2 (0.8-1.6)	0.373	1.2 (0.8-1.6)	0.346
Sepsis	1.1 (0.7-1.6)	0.759	1.1 (0.7-1.6)	0.734
Septic Shock	1.3 (0.8-2.2)	0.285	1.4 (0.8-2.3)	0.267
Organ/Space SSI	6.0 (0.7-49.9)	0.097	6.2 (0.7-51.4)	0.092
Readmission	1.2 (1.0-1.4)	0.055	1.2 (1.0-1.4)	0.049
Reoperation	1.0 (0.7-1.3)	1.000	1.0 (0.7-1.3)	0.999
Mortality	1.1 (0.9-1.3)	0.368	1.1 (0.9-1.4)	0.281

Table 2. Odds Ratios of Postoperative Outcomes in General Anesthesia Cohort Compared to Spinal Anesthesia Cohort.