Comparison of Anesthetic Types in the Setting of Total Knee Arthroplasty: A NSQIP Analysis between 2008 and 2016

Thy Vo, Harleen Kaur[1], Benjamin Krasnyanskiy, Adam J Wolfert[2], Shreya Jain, Ryan Kong, Steven Burekhovich, Aditya V Maheshwari[1], Qais Naziri[3]
[1]SUNY Downstate Medical Center, [2]SUNY Downstate Health Sciences University, [3]SUNY DOWNSTATE MEDICAL CENTER

INTRODUCTION: Total knee arthroplasty (TKA) is a common orthopaedic procedure increasing in frequency with the aging population. Previous studies showed that general anesthesia was associated with small but significant increased risks of complications compared to spinal anesthesia. Research, however, is lacking in studies examining the postoperative impacts of epidural anesthesia in patients undergoing TKA. This study compared 30-day postoperative outcomes between epidural anesthesia and spinal or general anesthesia.

METHODS: The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) 2008-2016 database was queried via CPT codes for TKA (27447). These procedures were then categorized into isolated general, spinal, or epidural anesthesia. One-to-one propensity score matched controlling for estimated probability of morbidity, age, and gender was performed. Patient demographics, comorbidities, and 30-day postoperative outcomes were collected. We compared outcomes between epidural anesthesia and spinal or general anesthesia. Univariate and multivariate logistic regression models controlling for the above covariates were used to determine anesthetic type as risk factor for adverse postoperative outcomes.

RESULTS: Between 2008 and 2016, 225,475 patients underwent TKA. A total of 1,854 (0.8%) patients were given epidural anesthesia, 78,874 (35.0%) were given general anesthesia, and 63,076 (28.0%) were given spinal anesthesia. After propensity matching, 1,146 patients in each group were selected. In the epidural vs. general anesthesia group, white (926, 86.8% vs. 742, 81.8%) patients were more likely given general anesthesia; African American (116, 10.9% vs. 123, 13.6%), Asian (18, 1.7% vs. 30, 3.3%), Native American (4, 0.4% vs. 6, 0.7%), and Hawaiian Native (6, 0.7% vs. 3, 0.3%) were more likely given epidural anesthesia ($p=0.017$). Epidural anesthesia was associated with longer length of hospital stay (4.1 days vs. 3.2 days, $p<0.001$) and operative time (110.7 min vs. 96.1 min, $p<0.001$). ASA class 1 and 2 were associated with epidural anesthesia (54, 4.7% vs. 16, 1.4%, 599, 52.3% vs. 533, 46.6%, $p<0.001$). ASA 3 and 4 were associated with general anesthesia (492, 42.9% vs. 595, 52.0%, $p<0.001$). Smokers (124, 10.8% vs. 87, 7.6%), patients with COPD (54, 4.7% vs. 32, 2.8%), and patients with bleeding disorder (39, 3.4% vs. 13, 1.1%) were more likely given general than epidural anesthesia ($p\geq0.007$). There was no difference in adverse events, postoperative complications, readmission, reoperation, or mortality between epidural and general anesthesia. Univariate and multivariate analysis found neither general nor epidural anesthesia to be predictor for adverse postop outcomes in TKA. In the epidural vs. spinal anesthesia group, more White (838, 89.1% vs. 742, 81.8%) patients were given general anesthesia, while more African American (78, 8.3% vs. 123, 13.6%), Asian (20, 2.1% vs. 30, 3.3%), Native American (4, 0.4% vs. 6, 0.7%), and Hawaiian Native (1, 0.1% vs. 6, 0.7%) were given epidural anesthesia ($p<0.001$). Epidural anesthesia was associated with longer length of hospital stay (4.1 days vs. 3.0 days, $p<0.001$) and operative time (110.7 min vs. 90.3 min, $p<0.001$). ASA 3 and 4 were associated with spinal anesthesia (492, 42.9% vs. 574, 50.1%, $p<0.001$) while ASA 1 and 2 were associated with epidural (54, 4.7% vs. 25, 2.3%, 599, 52.3% vs. 543, 47.9%, $p<0.001$). Diabetic and anemic patients were more likely to be given epidural (242, 21.1% vs. 195, 17.0%, 271, 23.6% vs. 204, 17.8%, $p\leq0.012$). Patients given epidural were more likely to have adverse events (170, 12.9% vs. 131, 11.4%, $p=0.016$), any postop complications (148, 38.8% vs. 104, 9.1%, $p=0.003$), and wound complications (114, 9.9% vs. 78, 6.8%, $p=0.007$), particularly bleeding requiring transfusion (105, 9.2% vs. 68, 5.9%, $p=0.003$). Univariate and multivariate analysis showed that epidural anesthesia was a risk factor for adverse events (OR=1.4, 95% CI=1.1 – 1.7, $p=0.017$), any postop complication (OR=1.5, 95% CI=1.1 – 2.0, $p=0.003$), and wound complications (OR=1.5, 95% CI=1.1–2.1, $p=0.006$), particularly bleeding requiring transfusion (OR=1.6, 95% CI=1.2 –2.3, $p=0.003$).

DISCUSSION AND CONCLUSION: Epidural anesthesia was associated with increased length of hospital stay and operative time compared to general and spinal anesthesia. Compared to spinal anesthesia, epidural anesthesia was a risk factor for increased adverse events and any postoperative complication, particularly wound complications. Future research is needed to elucidate the impact of epidural anesthesia on these outcomes in TKA.

Postoperative Outcomes	General Anesthesia N (%)	Epidural Anesthesia N (%)	P-value
Adverse Events	180 (15.7%)	170 (12.9%)	0.555
Any Postoperative Complication	155 (13.5%)	148(38.8%)	0.666
Wound Complications	121 (10.6%)	114 (9.9%)	0.631
Superficial SSI	5 (0.4%)	7 (0.6%)	0.564
Deep SSI	0 (0.0%)	0 (0.0%)	1.000
Wound Dehiscence	1 (0.1%)	2 (0.2%)	0.564
Bleeding Requiring Transfusion	114 (10.0%)	105 (9.2%)	0.518
Pulmonary Complications	15 (1.3%)	13 (1.1%)	0.702
Pneumonia	4 (0.3%)	4 (0.3%)	0.999
Pulmonary Embolism	7 (0.6%)	10 (0.9%)	0.466
Failure to Wean (Ventilator >48 hours)	2 (0.2%)	1 (0.1%)	0.563
Unplanned Intubation	5 (0.4%)	1 (0.1%)	0.102
Renal Complications	10 (0.9%)	13 (1.1%)	0.531
Progressive Renal Insufficiency	0 (0.0%)	0 (0.0%)	1.000
Acute Renal Failure	1 (0.1%)	0 (0.0%)	0.317
Urinary Tract Infection	9 (0.8%)	13 (1.1%)	0.393
Neuro Complications (CVA/Stroke)	2 (0.2%)	0 (0.0%)	0.157
Cardiac Complications	12 (1.0%)	12 (1.0%)	0.998
Cardiac Arrest	0 (0.0%)	0 (0.0%)	1.000
Myocardial Infarction	3 (0.3%)	2 (0.2%)	0.654
DVT/Thrombophlebitis	9 (0.8%)	10 (0.9%)	0.819
Sepsis-Related Complications	4 (0.3%)	4 (0.3%)	0.999
Sepsis	1 (0.1%)	3 (0.3%)	0.317
Septic Shock	1 (0.1%)	0 (0.0%)	0.317
Organ/Space SSI	3 (0.3%)	2 (0.2%)	0.654
Readmission	37 (3.2%)	34 (3.0%)	0.715
Reoperation	14 (1.2%)	13 (1.1%)	0.845
Mortality	1 (0.1%)	1 (0.1%)	1.000

Table 1. Postoperative Outcomes Between the General Anesthesia and Epidural Anesthesia.

Postoperative Outcomes	Spinal Anesthesia N (%)	Epidural Anesthesia N (%)	P-value
Adverse Events	131 (11.4%)	170 (12.9%)	0.016
Any Postoperative Complication	104 (9.1%)	148(38.8%)	0.003
Wound Complications	78 (6.8%)	114 (9.9%)	0.007
Superficial SSI	6 (0.5%)	7 (0.6%)	0.781
Deep SSI	3 (0.3%)	0 (0.0%)	0.083
Wound Dehiscence	2 (0.2%)	2 (0.2%)	1.000
Bleeding Requiring Transfusion	68 (5.9%)	105 (9.2%)	0.003
Pulmonary Complications	8 (0.7%)	13 (1.1%)	0.273
Pneumonia	2 (0.2%)	4 (0.3%)	0.414
Pulmonary Embolism	4 (0.3%)	10 (0.9%)	0.108
Failure to Wean (Ventilator >48 hours)	1 (0.1%)	1 (0.1%)	1.000
Unplanned Intubation	3 (0.3%)	1 (0.1%)	0.317
Renal Complications	11 (1.0%)	13 (1.1%)	0.682
Progressive Renal Insufficiency	1 (0.1%)	0 (0.0%)	0.317
Acute Renal Failure	3 (0.3%)	0 (0.0%)	0.083
Urinary Tract Infection	7 (0.6%)	13 (1.1%)	0.178
Neuro Complications (CVA/Stroke)	0 (0.0%)	0 (0.0%)	1.000
Cardiac Complications	16 (1.4%)	12 (1.0%)	0.447
Cardiac Arrest	3 (0.3%)	0 (0.0%)	0.083
Myocardial Infarction	4 (0.3%)	2 (0.2%)	0.414
DVT/Thrombophlebitis	11 (1.0%)	10 (0.9%)	0.826
Sepsis-Related Complications	9 (0.8%)	4 (0.3%)	0.164
Sepsis	2 (0.2%)	3 (0.3%)	0.654
Septic Shock	2 (0.2%)	0 (0.0%)	0.157
Organ/Space SSI	5 (0.4%)	2 (0.2%)	0.256
Readmission	38 (3.3%)	34 (3.0%)	0.632
Reoperation	20 (1.7%)	13 (1.1%)	0.220
Mortality	3 (0.3%)	1 (0.1%)	0.317

Table 2. Postoperative Outcomes Between the Spinal Anesthesia and Epidural Anesthesia Cohorts.