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

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INTRODUCTION: Total hip arthroplasties (THA) are major orthopaedic procedures in the United States with significant perioperative and postoperative morbidity. In recent years, spinal anesthesia has been the preferred choice over general anesthesia in THA with studies showing its advantages over general anesthesia. However, current research is still lacking regarding the impact of epidural anesthesia in postoperative outcomes when compared to general and spinal anesthesia in the setting of THA.

METHODS: The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) 2008-2016 database was queried via CPT codes for total hip arthroplasty (27130, 27132). These procedures were then categorized into isolated general, spinal, and epidural anesthesia groups. 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 general and epidural anesthesia, and epidural and spinal anesthesia. Univariate and multivariate logistic regression models controlling for the above covariates were used to determine anesthetic type as independent predictor for adverse postoperative outcomes.

RESULTS: Between 2008 and 2016, 143,752 patients underwent THA. Some 561 (0.4%) patients were given isolated epidural anesthesia, 62,982 (43.8%) were given isolated general anesthesia, and 41,969 (29.2%) were given isolated spinal anesthesia. After propensity matching, 375 patients in each group were selected. In the general vs. epidural cohort, the average age was 63.1 years, 330 (44%) were male, 420 (56%) were female, and 87.4% were white. In total, 411 (54.8%) had hypertension, 168 (22.4%) had anemia, 98 (13.1%) had diabetes, and 96 (12.8%) were smokers. A total of 142 (18.9%) experienced adverse events, 131 (17.5%) experienced any kind of complications with 113 (15.11%) experiencing wound complications, particularly bleeding requiring transfusions (106, 14.1%) (Table 1). Patients with higher estimated probability of mortality were more likely to be given general anesthesia (0.0018 vs. 0.0023, p=0.045). Patients with ASA 3 or 4 were more likely given general anesthesia (177, 47.2% vs. 148, 39.5%, p=0.033), while those with ASA 1 or 2 were more likely given epidural anesthesia (27, 7.2% vs. 13, 3.5%, p=0.044). Postoperatively, general anesthesia was associated with higher risks of sepsis-related complications (5, 1.3% vs. 0, p=0.025), DVT/thrombophlebitis (5, 1.3% vs. 0, 0%, p=0.025), readmissions (15, 4.0% vs. 6, 1.6%, p=0.046), and mortality (5, 1.3% vs. 0, 0%, p=0.025) (Table 1). Univariate analysis and multivariate logistical regression showed that general anesthesia was an independent predictor for increased risks of cardiac complications (OR=0.19, 95% CI=0.037-0.96, p=0.045) and readmissions (OR=0.37, 95% CI=0.14–1.0, p=0.050) compared to epidural anesthesia. In the epidural vs. spinal anesthesia cohort, the average age was 62.8 years, 336 (44.8%) were male, 414 (55.2%) were female, and 567 (88.6%) were white. A total of 391 (52.1%) had hypertension, 153 (20.4%) had anemia, 84 (11.2%) had diabetes, and 94 (12.5%) were smokers. Some 103 (13.7%) experienced adverse events, 92 (12.3%) experienced any kind of complications, with 79 (10.5%) experiencing wound complications (Table 2). BMI or ASA class was not found to be significantly associated with the anesthetic type. Patients given epidural anesthesia were more likely to have increased operative time compared to those given spinal anesthesia (108.6 vs. 84.4, p<0.001). Compared to spinal anesthesia, epidural anesthesia was associated with increased adverse events (66, 17.6% vs. 37, 9.9%, p=0.002), any postoperative complications (60, 16.0% vs. 32, 8.5%, p=0.003), and wound complications (54, 14.4% vs. 25, 6.7%, p<0.001), particularly bleeding requiring transfusions (52, 13.9% vs. 21, 5.6%, p<0.001) (Table 2). Univariate analysis and multivariate logistical regression showed that general anesthesia was an independent predictor for increased risks of adverse events (OR=1.8, 95% CI=1.2 - 2.8, p=0.009), any postoperative complications (OR=1.9, 95% CI=1.2-3.1, p=0.006), wound complications (OR=2.3, 95% CI=1.4-3.7, p=0.002), with increased risks for bleeding requiring transfusion (OR=2.6, 95% CI=1.5-4.4, p<0.001).

DISCUSSION AND CONCLUSION: Our study showed that spinal anesthesia and epidural anesthesia were more appropriate for patients undergoing THA compared to general anesthesia. Compared to general anesthesia, epidural anesthesia offered benefits in decreased hospital complications and readmissions. Compared to spinal anesthesia, epidural anesthesia was associated with increased risks of adverse events, wound complications, particularly bleeding requiring transfusions, and increased operative time. The results suggested that both spinal and epidural anesthesia offered advantages over general anesthesia. However, spinal anesthesia remained the preferred choice in the setting of THA.

Postoperative Outcomes	General Anesthesia N (%)	Epidural Anesthesia N (%)	P-value
Adverse Events	76 (20.3%)	66 (17.6%)	0.351
Any Postoperative Complication	71 (18.9%)	60 (16.0%)	0.290
Wound Complications	59 (15.7%)	54 (14.4%)	0.610
Superficial SSI	3 (0.8%)	3 (0.8%)	1.000
Deep SSI	2 (0.5%)	0 (0.0%)	0.157
Wound Dehiscence	1 (0.3%)	1 (0.3%)	1.000
Bleeding Requiring Transfusion	54 (14.4%)	52 (13.9%)	0.834
Pulmonary Complications	8 (2.1%)	2 (0.5%)	0.056
Pneumonia	6 (1.6%)	1 (0.3%)	0.058
Pulmonary Embolism	1 (0.3%)	0 (0.0%)	0.317
Failure to Wean (Ventilator >48 hours)	0 (0.0%)	1 (0.3%)	0.317
Unplanned Intubation	5 (1.3%)	1 (0.3%)	0.101
Renal Complications	7 (1.9%)	5 (1.3%)	0.561
Progressive Renal Insufficiency	2 (0.5%)	0 (0.0%)	0.157
Acute Renal Failure	1 (0.3%)	0 (0.0%)	0.317
Urinary Tract Infection	4 (1.1%)	5 (1.3%)	0.737
Neuro Complications (CVA/Stroke)	0 (0.0%)	0 (0.0%)	1.000
Cardiac Complications	8 (2.1%)	2 (0.5%)	0.056
Cardiac Arrest	3 (0.8%)	0 (0.0%)	0.083
Myocardial Infarction	0 (0.0%)	2 (0.5%)	0.157
DVT/Thrombophlebitis	5 (1.3%)	0 (0.0%)	0.025
Sepsis-Related Complications	5 (1.3%)	0 (0.0%)	0.025
Sepsis	2 (0.5%)	0 (0.0%)	0.157
Septic Shock	3 (0.8%)	0 (0.0%)	0.083
Organ/Space SSI	1 (0.3%)	0 (0.0%)	0.317
Readmission	15 (4.0%)	6 (1.6%)	0.046
Reoperation	5 (1.3%)	5 (1.3%)	1.000
Mortality	5 (1.3%)	0 (0.0%)	0.025

Table 1. Rate of Adverse Postoperative Outcomes Between the General Anesthesia and Epidural Anesthesia.

Postoperative Outcomes	Spinal Anesthesia N (%)	Epidural Anesthesia N (%)	P-value
Adverse Events	37 (9.9%)	66 (17.6%)	0.002
Any Postoperative Complication	32 (8.5%)	60 (16.0%)	0.003
Wound Complications	25 (6.7%)	54 (14.4%)	<0.001
Superficial SSI	2 (0.5%)	3 (0.8%)	0.654
Deep SSI	2 (0.5%)	0 (0.0%)	0.157
Wound Dehiscence	0 (0.0%)	1 (0.3%)	0.317
Bleeding Requiring Transfusion	21 (5.6%)	52 (13.9%)	<0.001
Pulmonary Complications	0 (0.0%)	2 (0.5%)	0.157
Pneumonia	0 (0.0%)	1 (0.3%)	0.317
Pulmonary Embolism	0 (0.0%)	0 (0.0%)	1.000
Failure to Wean (Ventilator >48 hours)	0 (0.0%)	1 (0.3%)	0.317
Unplanned Intubation	0 (0.0%)	1 (0.3%)	0.317
Renal Complications	7 (1.9%)	5 (1.3%)	0.561
Progressive Renal Insufficiency	0 (0.0%)	0 (0.0%)	1.000
Acute Renal Failure	0 (0.0%)	0 (0.0%)	1.000
Urinary Tract Infection	7 (1.9%)	5 (1.3%)	0.561
Neuro Complications (CVA/Stroke)	1 (0.3%)	0 (0.0%)	0.317
Cardiac Complications	1 (0.3%)	2 (0.5%)	0.563
Cardiac Arrest	0 (0.0%)	0 (0.0%)	1.000
Myocardial Infarction	0 (0.0%)	2 (0.5%)	0.157
DVT/Thrombophlebitis	1 (0.3%)	0 (0.0%)	0.317
Sepsis-Related Complications	0 (0.0%)	0 (0.0%)	1.000
Sepsis	0 (0.0%)	0 (0.0%)	1.000
Septic Shock	0 (0.0%)	0 (0.0%)	1.000
Organ/Space SSI	0 (0.0%)	0 (0.0%)	1.000
Readmission	9 (2.4%)	6 (1.6%)	0.434
Reoperation	5 (1.3%)	5 (1.3%)	1.000
Mortality	0 (0.0%)	0 (0.0%)	1.000

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