Neuraxial Anesthesia Has Lower Risk of Complications After Total Knee Arthroplasty

David H Mai, Abdullah Uddin, Bruce Zhang, Dhruva Manoj Chhabra, Jack Jing Zhou, Ryne Jack Veenema, Eric N Windsor, Qais Naziri, Aditya V Maheshwari

INTRODUCTION:

Total knee arthroplasty is among the most common surgical procedures performed in the United States. Procedure-related complications, as defined by the Comprehensive Care for Joint Replacement (CCJR) Model, may impair patient outcomes and create a financial burden for the healthcare system. This study sought to assess the relationship between neuraxial anesthesia (NA) on procedure-related complications among patients who underwent primary total knee arthroplasty (TKA).

METHODS: A retrospective cohort study was performed using the National Surgical Quality Improvement Program (NSQIP) database of primary TKA occurring between 2012 and 2020. The primary exposure was anesthesia modality (NA versus general anesthesia [GA]). NA was defined as epidural or spinal anesthesia. The primary outcome was procedure-related complications, as defined by the CCJR Model Technical Expert Panel. Potential confounders included basic demographics (age, sex, race, ethnicity), baseline health status (preoperative functional status, ASA classification, BMI, smoking, diabetes, chronic immunosuppression), and procedure characteristics (admission source, procedural setting, operative time, and wound classification). Univariate analyses were performed to assess for differences between cohorts. Multivariable regression analysis that adjusted for confounding was performed to identify risk of anesthesia modality on procedure-related complications following TKA.

RESULTS:

Over the study period, there were 370,361 cases of TKA, of which 178,384 (48.16%) received NA. Many patients in both cohorts had age 65-74 years, female sex, White race, non-Hispanic ethnicity, independent functional status, obesity, no smoking, no diabetes, no chronic immunosuppression, admission from home, and inpatient setting. In contrast, a higher proportion of patients who received NA versus GA had ASA class 3 versus 2, respectively. On multivariable regression analysis, patients who received NA versus GA had 0.79 times lower odds (95% CI 0.74 to 0.84; $p<0.001$) of procedure-related complications following TKA.

DISCUSSION AND CONCLUSION:

Compared to patients who received GA, those who received NA for TKA had a lower risk of procedure-related complications following surgery. Further research into ideal candidates for nexuraxial anesthesia may minimize reduce procedure-related complications and optimize outcomes.

Table 1: Univariate Analysis of Patients Undergoing Total Knee Arthroplasty with Neuraxial or General Anesthesia

	Neuraxial N = 178384 (48.16%)	General N = 191977 (51.835%)	p-value*
Age Group			<0.001
18-54	14,277 (8.0%)	21,214 (11%)	
55-64	50,919 (29%)	58,764 (31%)	
65-74	72,060 (40%)	72,980 (38%)	
75-84	36,114 (20%)	34,695 (18%)	
85	5,014 (2.8%)	4,320 (2.3%)	
Sex			0.003
Female	109,176 (61%)	118,422 (62%)	
Male	69,208 (39%)	73,555 (38%)	
Race			<0.001
White	118,819 (88%)	152,568 (86%)	
American Indian or Alaska Native	528 (0.4%)	1,137 (0.6%)	
Asian	4,367 (3.2%)	3,891 (2.2%)	
Black or African American	10,462 (7.8%)	18,541 (10%)	
Native Hawaiian or Pacific Islander	568 (0.4%)	657 (0.4%)	
Other	22 (<0.1%)	10 (<0.1%)	
Ethnicity			<0.001
Non-Hispanic	126,763 (72%)	163,144 (86%)	
Hispanic	8,127 (4.6%)	11,987 (6.3%)	
Unknown	41,753 (24%)	15,559 (8.2%)	
Functional Status Prior to Surgery			<0.001
Dependent	1,541 (0.9%)	2,586 (1.4%)	
Independent	176,097 (99%)	188,365 (99%)	
ASA Classification			<0.001
1-No Disturb	2,691 (1.4%)	4,010 (2.3%)	
2-Mild Disturb	85,874 (45%)	91,955 (52%)	
3-Severe Disturb	99,707 (52%)	79,344 (45%)	
4/5-Life Threat/Moribund	3,567 (1.9%)	2,400 (1.3%)	
BMI Category			<0.001
Normal	17,813 (10.0%)	16,177 (8.4%)	
Obese	108,842 (61%)	126,656 (66%)	
Overweight	50,540 (28%)	48,044 (25%)	
Underweight	1,189 (0.7%)	920 (0.5%)	
Smoking Status	12,715 (7.1%)	17,648 (9.2%)	
Diabetes			<0.001
No	147,862 (83%)	154,669 (81%)	
Insulin	7,009 (3.9%)	9,271 (4.8%)	
Non-Insulin	23,513 (13%)	28,037 (15%)	
Immunosuppressive Therapy	5,793 (3.2%)	7,306 (3.8%)	<0.001
Admission Origin			<0.001
Home	177,557 (100%)	191,120 (100%)	
Institution	385 (0.2%)	657 (0.3%)	
Setting			<0.001
Inpatient	154,569 (87%)	172,980 (90%)	
Outpatient	23,815 (13%)	18,997 (9.9%)	
Operation Time in Minutes Mean (SD)	88 (34)	96 (40)	
Wound Classification			<0.001
1-Clean	177,729 (100%)	190,919 (99%)	
2-Clean/Contaminated	506 (0.3%)	761 (0.4%)	
3-Contaminated	104 (<0.1%)	154 (<0.1%)	
4-Dirty/Infected	45 (<0.1%)	143 (<0.1%)	
Procedure Related Complications	2,054 (1.2%)	2,997 (1.6%)	<0.001
Acute Myocardial Infarction	341 (0.2%)	378 (0.2%)	0.692
Pneumonia	397 (0.2%)	657 (0.3%)	<0.001
Sepsis	251 (0.1%)	369 (0.2%)	<0.001
Pulmonary Embolism	662 (0.4%)	705 (0.4%)	0.846
Periprosthetic Joint Infection	77 (<0.1%)	282 (0.1%)	<0.001
Mechanical Complications	168 (<0.1%)	361 (0.2%)	<0.001

*Pearson's Chi-Squared Test; Fisher's Exact Test; Wilcoxon Rank Sum Test

Table 2: Adjusted Multivariable Regression of Neuraxial Anesthesia and Procedure Related Complications

	Procedure Related Complications		
	OR[a]	95% CI[b]	p-value
General	---	---	
Neuraxial	0.79	0.74-0.84	<0.001

[a] Odds Ratio [b] Confidence Interval