The Dose of Spinal Anesthesia Predicts Length of Stay in Total Knee Arthroplasty Conducted in the Hospital Outpatient Department Setting

Mikhail Kuznetsov, Hannah I Travers, Katharine P Playter, Sophia M Ly, Ruijia Niu, Eric Louis Smith

INTRODUCTION: The implementation of spinal anesthesia in total knee arthroplasty (TKA) has been shown to shorten hospital length of stay (LOS) compared to general anesthesia. However, despite these advances, lengths of stay for outpatient total knee arthroplasty remain high. We examined the association between the dose of spinal anesthesia and LOS in patients undergoing primary TKA in the Hospital Outpatient Department (HOPD) setting.

METHODS: We conducted a retrospective review of internal medical records for patients who underwent primary TKA at a single institution from 6/1/2024 – 4/1/2025. Demographic data, comorbidities, surgeon, anesthesiologist details, spinal anesthetic details, and LOS were collected. For uniformity, only patients who received bupivacaine were included. Univariate and multivariable analysis were conducted using R (R version 4.4.3; R Core Team (2025), Vienna, Austria).

RESULTS: A total of 1,485 patients were included in the study. Summary and demographics are represented in Table 1. Multivariate regression analysis revealed that dose of spinal anesthetic (β =12.6, p=0.002), age (β =0.36, p<0.001), and BMI (β =0.29, p=0.03) were predictors of increased LOS. (Table 2) Male gender was predictive of lower LOS (β =-5.6, p=0.002). Anesthetic dose had the strongest influence on LOS in an aggregated variable importance model.

DISCUSSION AND CONCLUSION: In this retrospective analysis, higher dosing of spinal anesthesia led to longer lengths of stay, even when adjusting for surgeon and anesthesiologist. A 0.1mL increase in bupivacaine dosing was noted to increase the length of stay by over 75 minutes. The range of spinal dosing was 1.0ml to 3.0ml. The largest increases in LOS occurred at greater than 1.6mL. (Figure 1) Thus, we recommend that surgeons and anesthesiologists aiming to lower length of stay for their HOPD TKA patients adjust their dosing to equal to- or lower than 1.6mL bupivacaine. Prospective studies are warranted to confirm these results.

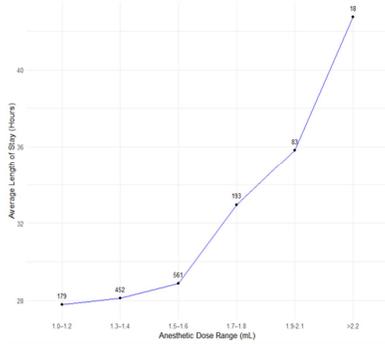Average Outpatient Primary TKA LOS by Anesthetic Dose Bin (with Count Labels)

Table 1. Summary of Total Knee Arthroplasty Spinal Anesthesia Demographics

	Number of patients	1486
Age (mean (SD))		69.10 (8.50)
BMI (mean (SD))		31.56 (6.42)
Sex (%)		
F		896 (60.3)
M		590 (39.7)
Smoking Status (%)		
Every Day		18 (1.4)
Some Days		15 (1.2)
Former		471 (36.6)
Never		749 (58.2)
Never Assessed		22 (1.7)
Unknown		11 (0.9)
ASA Score (%)		
1		4 (0.3)
2		607 (47.6)
3		662 (51.9)
4		2 (0.2)
Length of Stay Hours (mean (SD))		29.60 (22.04)
Anesthesiologist Years Since Graduation (mean (SD))		27.60 (10.93)
Spinal Level (%)		
L1-2		7 (0.6)
L2-3		185 (14.5)
L3-4		986 (77.5)
L4-5		90 (7.1)
L5-S1		4 (0.3)
Anesthetic Dose (mean (SD))		1.54 (0.24)
Procedure Time Min (mean (SD))		79.68 (23.04)
Bolus Given? (%)		
Y		241 (13.4)
N		1,245 (86.6)
Discharge Disposition (%)		
Home with services		1123 (75.7)
Home without services		309 (20.8)
Rehab Facility		7 (0.5)
Skilled Nursing Facility		35 (2.1)
Acute Rehab		7 (0.5)
Home Hospice		1 (0.1)
Transfer to Acute Care Hospital		1 (0.1)

Table 2. Multivariable Linear Regression for predictors of Length of Stay

Variable	Estimate	95% CI	p-value
Anesthetic Dose	12.6	(4.5, 20)	0.002
Age	0.36	(0.16, 0.57)	<0.001
Body Mass Index	0.29	(0.025, 0.55)	0.032
Male Sex	-5.6	(-9.1, -2.10)	0.002
Smoking Status			
Every Day	REF	REF	REF
Former	-0.680	(-15, 14)	0.93
Never	0.220	(-14, 14)	0.98
Never Assessed	0.660	(-17, 18)	0.94
Some Days	-0.870	(-25, 23)	0.94
Unknown	2.300	(-20, 24)	0.84
Anesthesiologist Experience Level (Years Since Graduation)	0.004	(-0.140, 0.15)	0.96
Surgeon			
1	REF	REF	REF
2	-7.3	(-35, 20)	0.60
3	3.5	(-8.5, 15)	0.57
4	-6	(-19, 6.80)	0.36
5	-9.3	(-23, 4.20)	0.18
6	-0.730	(-12, 10)	0.90
7	-9	(-21, 2.50)	0.12
8	-2.8	(-14, 8.60)	0.64
9	-0.380	(-11, 10)	0.94
10	9.8	(-9.6, 29)	0.32
11	-4.1	(-15, 6.30)	0.44
12	2.2	(-11, 15)	0.74
13	0.470	(-12, 13)	0.94
14	3.6	(-7.4, 14)	0.52
15	-1.4	(-13, 10)	0.81
16	-4.4	(-16, 7.70)	0.48
Spinal Level			
L1-2	REF	REF	REF
L2-3	-40	(-59, -21)	<0.001
L3-4	-41	(-59, -22)	<0.001
L4-5	-37	(-57, -18)	<0.001
L5-S1	-19	(-50, 13)	0.25
Pre-Operative Creatinine Value	12	(3.8, 19)	0.004
Procedure Time Min	0.031	(-0.08, 0.14)	0.60