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Disparities in the Use of Neuraxial/Regional Anesthesia in Hip Fractures and Associated Impact on Complications and Costs

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Introduction

Regional anesthesia (RA) has been shown to decrease post-operative opioid consumption, time to discharge, and incidence of cardiopulmonary complications as compared to general anesthesia in bundled orthopaedic procedures such as total joint arthroplasty (TJA), for which improving quality of care and outcomes while reducing unnecessary costs are critical. Despite RA's documented benefits, racial disparities in provision of RA for TJA have been described, suggesting room for improvement towards equitable perioperative outcomes and value in other lower extremity orthopaedic procedures.
Hip fracture patients provide a non-elective, high-burden, high-volume cohort to study the effectiveness of and potential disparities in RA as one modality for reducing post-surgical complications and low-value inpatient resource utilization after surgery.
This study aimed to answer the following in propensity-matched cohorts of isolated hip and femoral shaft fracture patients undergoing operative treatment: 1) Does race or gender modify the effect of neuraxial (as compared to general) anesthesia on rate of post-operative complications, readmission, and inpatient resource utilization? 2) Is race or gender associated with differences in neuraxial anesthesia use?

Materials and Methods

The American College of Surgeons National Quality Improvement Program (ACS-NSQIP) national surgical database was queried for all isolated hip and femoral shaft fractures based on current procedural terminology codes. Within each sex-race unique stratum, patients who received neuraxial versus general anesthesia were propensity-matched in a 1:2 ratio using the nearest distance method without replacement. To test the effect modification of sex and race, logistic regression (for binary outcomes) and negative bionomial regression (for length of stay) were performed on the propensity-matched cohort. The outcome models included with anesthesia type, race or sex, and the corresponding interaction term as covariates. Stepwise logistic regression was then performed on the full (non-propensity matched) hip fracture cohort in order to assess whether gender or race were independent predictors of use of neuraxial use. As this retrospective analysis is devoid of patient identifiable information, it is exempt from IRB review requirements as per Icahn School of Medicine at Mount Sinai policy.

Results/Case Report

The initial query identified 12,004 and 64,250 neuraxial and general anesthesia hip/femoral shaft fracture patients (Table 1). Propensity-matching (1 neuraxial : 2 general anesthesia cases) yielded a cohort of 11,993 and 23,946 patients, respectively. Adequacy of propensity-matching was confirmed by reduction in standardized mean differences in overall propensity scores (Figure 1). Logistic/negative binomial regression analysis for the matched cohort found neuraxial anesthesia was protective against prolonged length of stay (OR 0.93, $p<0.001$), 30-day severe adverse events (SAEs, OR 0.92, $p=0.03$), and acute rehab/skilled nursing facility discharge (OR 0.89, $p<0.001$) for White patients ($p<0.05$ for all), but only protective against length of stay in Hispanic and Black patients (OR 0.89 and OR 0.86, respectively; $p=0.02$ and $p=0.01$, respectively; Table 2). Similar analysis assessing effect modification by sex demonstrated neuraxial anesthesia to be protective against prolonged length of stay (OR 0.90, $p<0.001$), 30-day SAEs (OR 0.90, $p=0.01$), and acute rehab/skilled nursing facility discharge (OR 0.85, $p<0.001$) in females but only against prolonged length of stay (OR 0.91, $p<0.001$) in males. Among all patients (without propensity-matching), Hispanic and Black patients were 0.61 and 0.61 times less likely to receive neuraxial over general anesthesia as compared to White patients ($p<0.05$, Table 3).

Discussion

Notable disparities exist with respect to neuraxial anesthesia in isolated hip and femoral shaft fracture patients. Hispanic/Black (compared to White) race and Female gender in particular influence the potential beneficial effects of neuraxial anesthesia on post-operative adverse events and resource utilization. Further research is required to understand root causes for and address these disparities in access to and benefits of regional anesthesia in this high-volume, high-burden patient population.

References

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Disclosures

No

Tables / Images

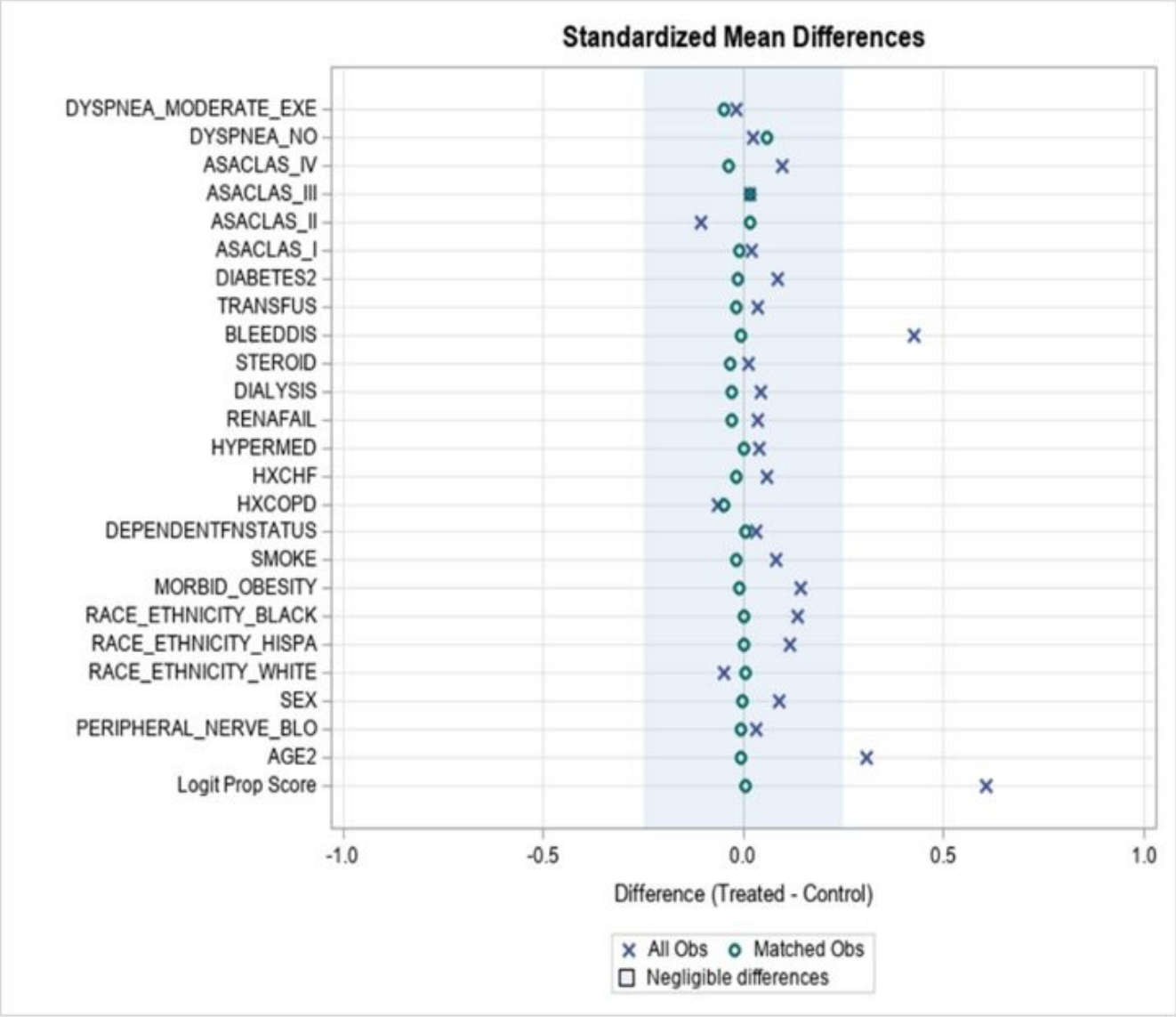

Figure 1. Within each sex-race unique stratum, patients who received neuraxial versus general anesthesia were propensity-matched in a 1:2 ratio using the nearest distance method without replacement. The matched cohort includes 11,993 neuraxial and 23,946 general anesthesia patients

Table 1. Comparison of patient/procedure characteristics among general versus neruaxial anesthesia patients without prior to propensity-matching

	General anesthesia 64,520 (100%)	**Neuraxial anesthesia** 12,004 (100%)	*p-value*
Age (mean)	78 (SD 12)	81 (SD 9)	<0.001
Race/ethnicity			<0.001
White	55,927 (87%)	10,596 (88%)	
Black/African American	3,174 (4.9%)	327 (2.7%)	
Hispanic	3,345 (5.2%)	380 (3.2%)	
Other	2,074 (3.2%)	701 (5.8%)	
Male gender	20,347 (32%)	3,310 (28%)	<0.001
Dependent functional status	13,34 (21%)	2,322 (19%)	0.003
BMI > 40	1,625 (2.5%)	127 (1.1%)	<0.001
History of smoking	8,617 (13%)	1,298 (11%)	<0.001
History of diabetes	12,578 (20%)	1,970 (16%)	<0.001
History of pulmonary disease	6,868 (11%)	1,541 (13%)	<0.001
History of chronic heart failure	2,43 (3.7%)	335 (2.8%)	<0.001
Hypertension	43,281 (67%)	7,835 (65%)	<0.001
History of renal disease	439 (0.7%)	53 (0.4%)	0.002
Steroids for chronic condition	3,586 (5.6%)	637 (5.3%)	0.28
Bleeding-causing disorders	11,795 (18%)	871 (7.3%)	<0.001
Pre-operative blood transfusion	2,797 (4.3%)	443 (3.7%)	0.001
ASA class 3/4	53,174 (82%)	9,398 (78%)	<0.001
Laboratory results within 90 days preop.			
Low platelets (<100,000/mcL)	2,655 (4.1%)	232 (1.9%)	<0.001
High INR (>1.4)	58,766 (91%)	284 (2.4%)	<0.001
Peripheral nerve block	2,806 (4.4%)	447 (3.7%)	0.002
Operative time (mean)	69 (SD 44)	66 (SD 39)	<0.001
Hospital LOS (mean)	5.8 (SD 4.2)	5.1 (SD 3.6)	<0.001
Discharge Disposition			<0.001
Acute rehab facility	14,167 (22%)	2,666 (21%)	
Skilled nursing facility	34,658 (54%)	7,135 (56%)	
Home/other	15,695 (24%)	2,924 (23%)	

BMI = Body Mass Index, ASA Class = American Society of Anesthesiology Classification System, LOS = Length of Stay, WBC = White Blood Cell, INR = International Normalized Ratio

Table 2. Propensity score-matched analysis assessing effect modification by race and sex of neuraxial anesthesia effect on post-operative outcomes and resource

	Length of Stay		**Acute Rehab/SNF Discharge**		**30-day Unplanned Readmission**		**30-day Adverse Events**	
	Mean ratio (95% CI)[1]	*p-value*[2]	Odds Ratio (95% CI)[1]	*p-value*[2]	Odds Ratio (95% CI)[1]	*p-value*[2]	Odds Ratio (95% CI)[1]	*p-value*[2]
Effect modification of Race/ethnicity		0.01		0.01		0.28		0.68
White	0.93 (0.91-0.94)	*	0.89 (0.84-0.93)	*	1.04 (0.96-1.14)		0.92 (0.86-0.99)	*
Black/African American Race	0.86 (0.78-0.96)	*	0.85 (0.64-1.13)		0.79 (0.50-1.25)		0.74 (0.50-1.10)	
Hispanic Race	0.89 (0.81-0.98)	*	1.29 (0.97-1.72)		1.01 (0.68-1.46)		0.86 (0.57-1.31)	
Other Race	0.86 (0.81-0.93)	*	0.73 (0.60-0.88)	*	1.36 (0.97-1.89)		0.99 (0.74-1.36)	
Effect modification of Sex		0.53		0.01		0.17		0.31
Female	0.92 (0.91-0.94)	*	0.85 (0.80-0.90)	*	1.01 (0.91-1.11)		0.90 (0.82-0.98)	*
Male	0.91 (0.88-0.94)	*	0.97 (0.89-1.07)		1.13 (0.99-1.29)		0.97 (0.86-1.08)	

SNF = skilled nursing facility

1 As compared to general anesthesia reference

2 P-value for the race or sex interaction with anesthesia type

* indicates a significant odds ratio for neuraxial anesthesia effect on post-operative outcomes and resource utilization

Table 3. Factors associated with neuraxial anesthesia use in non-propensity matched hip fracture patients

Risk Factors	Odds Ratio (95% CI)	p-value
Age	1.03 (1.02-1.04)	<0.001
Operative time	-	-
Black/African American[1]	0.64 (0.57-0.72)	<0.001
Hispanic[1]	0.61 (0.55-0.68)	<0.001
Other[1]	1.79 (1.63-1.95)	<0.001
Male gender	-	-
Dependent functional status	0.88 (0.83-0.92)	<0.001
BMI > 40	0.56 (0.47-0.68)	<0.001
History of smoking	-	-
History of diabetes	-	-
History of pulmonary disease	1.44 (1.35-1.54)	<0.001
History of chronic heart failure	0.82 (0.73-0.93)	0.001
Hypertension	0.92 (0.88-0.96)	0.001
History of renal disease	-	-
Steroids for chronic condition	-	-
Bleeding-causing disorders	0.35 (0.32-0.38)	<0.001
Pre-operative blood transfusion	-	-
ASA class 3/4	0.71 (0.56-0.91)	<0.001
Laboratory results within 90 days preop. (%)	-	-
Low platelets (<100,000/mcL)	-	-
High INR (>1.4)	-	-

BMI = Body Mass Index, ASA Class = American Society of Anesthesiology Classification System, LOS = Length of Stay, WBC = White Blood Cell, INR = International Normalized Ratio

1 As compared to Caucasian race reference