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Clinical Studies

The effect of low preoperative platelet count on adverse outcomes following lumbar microdiscectomy ☆☆☆★

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ABSTRACT

Background: Low preoperative platelet count, or thrombocytopenia, has previously been associated with increased complications in elective spine surgeries. No other study has investigated the effects of abnormal coagulation profiles on postoperative outcomes specific to lumbar microdiscectomy (MLD) using a propensity matched cohort. **Methods:** Patient data was retrospectively retrieved from the National Surgical Quality Improvement Program database using Current Procedural Terminology (CPT) code 63030 to isolate patients who solely underwent MLD. Data was collected from 2010 to 2019 and included preoperative, perioperative, and 30-day postoperative variables. Patients were grouped into four platelet categories for ANOVA analysis and pairwise comparisons: Severe Thrombocytopenia (≤ 100), Thrombocytopenia (101-150), Moderate (151-199), and Normal (200-450). Variables that were significant in the univariate analysis were used in the multivariate analysis to determine the likelihood of experiencing adverse postoperative events – unplanned return to the operating room and surgical site infection. A propensity matched analysis was performed to control for confounding variables.

Results: A total of 64,747 patients were identified within the 10-year period. The results of the multivariate analysis and the propensity matched analysis showed no significant differences in low preoperative platelet count as an independent predictor of experiencing a return to the operating room or surgical site infection. Furthermore, patients who had diabetes, history of smoking, or had emergency cases were associated with a high likelihood of experiencing these negative adverse events.

Conclusion: Thrombocytopenia does not appear to independently predict return to the operating room or postoperative infection following MLD. Proper preoperative management strategies should be implemented to monitor comorbidity burden which would otherwise influence adverse outcomes in patients with thrombocytopenia undergoing MLD.

Introduction

Lumbar microdiscectomy is one of the most common decompressive spine surgeries. Although the procedure is relatively low risk, surgical approach and technique compounded with comorbidities can lead to unfavorable outcomes [1]. Emphasis on preoperative optimization including assessment of patient-specific factors such as medical comorbidities can influence postoperative complications following surgery [2].

Coagulation abnormalities have been correlated with complications across different types of surgeries [3]. Patients with thrombocytopenia, or preoperative platelet counts below 150,000 μL , have been shown to experience increased risk of postoperative adverse events such as infection, sepsis and return to the operating room [4]. Chow *et al* [5] iden-

tified risk of allogeneic transfusion following posterior spine surgery in patients with thrombocytopenia, noting that patients with platelet counts below 100,000 μL had a five-time increase in risk of transfusion. In another study of 137,709 posterior lumbar spine cases, Malpani *et al* [6] demonstrated that patients with preoperative platelet counts below 140,000 μL were associated with a higher likelihood of adverse events, readmissions, and transfusions.

Prior studies have reported perioperative risk following elective spine surgeries using either a spectrum or stratification of preoperative platelet counts. However, data-driven approaches to distinguish postoperative complications in propensity matched cohorts have not been utilized for patients who solely underwent lumbar microdiscectomy. This study aims to gather high quality retrospective data from the American College of Surgeons National Surgical Quality Improvements Program

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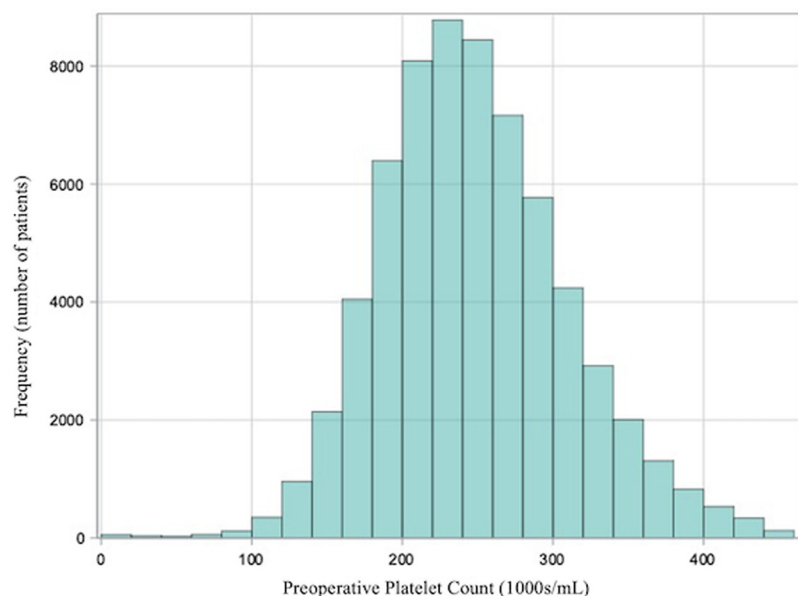


Fig. 1. Preoperative platelet count distribution of 64,747 patients were identified in the 10-year period between 2010 and 2019.

(NSQIP) database to identify postoperative risk outcomes and complications associated with low platelet values following lumbar microdiscectomy.

Methods and materials

Database and population

Retrospective data was retrieved from the NSQIP ACS database which aggregates around 250 HIPAA compliant variables on cases submitted from more than 700 sites [7,8]. Patients who underwent lumbar microdiscectomy were identified using Current Procedural Terminology (CPT) code 63030 to assess demographic variables, health history, comorbidities, and postoperative events limited to 30 days following surgery.

Our study collected reports from 2010 to 2019 including a total of 77,059 patients within the 10-year period. However, the final analytical population was 64,747 patients due to the exclusion of patients over the age of 90, patients with preoperative platelet counts greater than 450,000 μL and unreported or unknown preoperative platelet counts. Izak and Bussel [9] reported normal cutoff platelet counts at 450,000 μL . Patients with values greater than that threshold are considered to have thrombocytosis and were therefore excluded from this study.

Patient data

Initially, the preoperative platelet counts were categorized into four groups: Severe Thrombocytopenia (≤ 100), Thrombocytopenia (101-150), Moderate (151-199), and Normal (200-450). Descriptive statistics were generated for demographic, health history, and comorbid disease. American Society of Anesthesiologists (ASA) classification was included as a scoring system for evaluation of perioperative risks based on patient health and comorbidities [10]. For categorical variables, frequency and percentages were reported. The mean and standard deviation were reported for continuous variables. In cases where the distribution of data for continuous characteristics was not normal, the median and interquartile ranges (IQR) were reported alongside the mean and standard deviation. In addition, a histogram plot was used to display the frequency of preoperative platelet counts in the data sample (Fig. 1).

Statistical analysis

A Chi-square test and Fisher's Exact test were conducted to compare the relationship between categorical patient characteristics and preoperative platelet status. A One-way ANOVA and Kruskal Wallis test were conducted to compare the relationship between continuous patient characteristics and preoperative platelet status. Pairwise comparisons were subsequently used to assess which two groups were significant for both the categorical and continuous characteristics when examining the relationship between these characteristics and preoperative platelet status.

Additionally, Fisher's Exact Test was used to compare categorical patient characteristics with postoperative adverse events - return to the operating room and surgical site infection. These postoperative outcomes were chosen based on clinical relevance and statistical power. An independent two-sample t-test, Wilcoxon (Mann-Whitney), was used to compare the relationship between continuous patient characteristics and the two postoperative adverse events.

The assessments of risk factors for the adverse outcomes, return to the operating room and surgical site infection, were conducted through univariate logistic regression modeling and multivariate stepwise logistic regression modeling. Variables included in the univariate logistic regression models were also included in the multivariate stepwise logistic regression. The final multivariate stepwise logistic regression model consisted of variables which met the entry and remaining criteria of a significance level of a P value ≤ 0.05 and exclusion of P value > 0.10 .

Propensity matching

A subset analysis was performed using propensity matching to examine the effect of preoperative platelet status on adverse outcomes in matched cohorts. New preoperative platelet status variables were created by combining Severe Thrombocytopenia (≤ 100) and Thrombocytopenia (101-150) into a single group called Thrombocytopenia. In the second group, we combined platelet counts of Moderate (151-199) and Normal (200-450) which we called Normal (Table 4).

Standardized differences were calculated and reported to observe balance in characteristics between patients with Thrombocytopenia and patients with Normal platelet count, before and after matching. A 1:1 greedy propensity-score matching procedure was used in which unbalanced characteristics with standardized differences greater than 10% were included in the model and matched. The following are the unbal-

anced variables: age, sex, diabetes, dyspnea, hypertension with medication required, disseminated cancer, bleeding disorder, and ASA classification. Three separate logistic regression models (Model 1, Model 2, and Model 3) were generated to observe the effect of preoperative platelet status in the matched samples for each of the adverse outcomes (return to the operating room and surgical site infection).

For each adverse outcome in Table 5, Model 1 displayed the unadjusted odds ratio of experiencing the outcome according to preoperative platelet status. Model 2 displayed the adjusted odds ratio of experiencing the outcome according to preoperative platelet status when controlling for matched variables (i.e. age, sex, diabetes, dyspnea, ASA classification, hypertension with medication required, disseminated cancer, bleeding disorder). Model 3 displayed the adjusted odds ratio of experiencing the outcome according to preoperative platelet status when controlling for matching variables and possible confounders (i.e. Age, Sex, Ascites, Diabetes, Dyspnea, ASA Classification, Hypertension with medication required, Disseminated Cancer, Bleeding Disorder, preoperative white blood cell count, and preoperative hematocrit). All analyses were performed in SAS Enterprise Guide v8.2 (SAS, Inc.; Cary, NC) and R package version 64 4.0.3, with contrasts of $P < 0.05$ considered statistically significant.

Results

A total of 64,747 patients who underwent lumbar microdiscectomy between 2010 and 2019 were analyzed. The mean age of patients was 52.3 ± 15.7 years with a higher percentage of patients being in the range of 36-65 years old (60.0%) and the mean operation time was 94.3 ± 57.3 minutes. There were more male than female patients (55.6% vs 44.4%) and most patients were white (78.3%). Patients who had severe thrombocytopenia and thrombocytopenia were more likely to have an ASA III classification ($P = 0.001$). There was a significant association between all the characteristics except for ventilator dependence and preoperative platelet status ($P = 0.06$). Patients who were classified as having thrombocytopenia were more likely to be male compared to the other platelet groups (Table 1 provides more information). Pairwise comparisons revealed patients classified as having severe thrombocytopenia were significantly more likely to be diabetic (26.9% vs 13.6%, $P < 0.0001$), have dyspnea (8.0% vs 3.0%, $P < 0.0001$), ascites (0.6% vs 0%, $P < 0.0001$), and hypertension with medication required (50.0% vs 38.6%, $P < 0.0001$) compared to patients classified as having a normal platelet status (200-450).

The univariate logistic regression showed that preoperative platelet status, sex, diabetes, smoking status, ASA classification, and many other variables were significantly associated with the adverse outcomes of interest. Patients classified as having severe thrombocytopenia had an increased likelihood of returning to the operating room (OR 2.17; 95% CI 1.29, 3.66; $P = 0.004$), and experiencing surgical site infection (OR 3.25; 95% CI 1.29, 3.80; $P = 0.004$). Patients who were female had 17% increased odds of returning to the operating room compared to male patients (OR 1.17; 95% CI 1.06, 1.30; $P = 0.003$). Diabetes was also a predictor of experiencing adverse outcomes with an increased odds of returning to the operating room (OR 1.44; 95% CI 1.26, 1.65; $P < 0.0001$), and surgical site infection (OR 1.52; 95% CI 1.22, 1.89; $P = 0.0002$). Table 2 provides more information.

Table 3 displays the variables that were entered and remained in the final multivariate logistic regression model among the adverse outcomes. The variables listed in Table 3 are statistically significant predictors of either a return to the operating room or surgical site infection when accounting for other variables. Patients who were current smokers had 47% increased odds of returning to the operating room (OR 1.47; 95% CI 1.23, 1.76; $P < 0.0001$), and 99% increased odds of experiencing a surgical site infection (OR 1.99; 95% CI 1.47, 2.68; $P < 0.0001$). Patients with emergency cases were more likely to return to the operating room (OR 2.50; 95% CI 1.76, 3.49; $P < 0.0001$). Although the independent assessment of platelet count in the univariate analysis was a

predictor of adverse outcomes, the multivariate analysis model showed no significance in platelet count when adjusting for other variables and confounders. With regards to goodness of fit of the model, the Hosmer and Lemeshow Goodness-of-Fit test statistics demonstrated it was acceptable ($X^2=11.86$, $df=8$, $P = 0.157$).

Table 4 displays a comparison of patient characteristics before and after propensity matching. After balancing the following variables, the standardized differences were less than 10%: age, sex, diabetes, dyspnea, hypertension with medication required, disseminated cancer, bleeding disorder, and ASA classification. In the propensity matched sample, the Thrombocytopenia group (platelet count <150) showed increased occurrence of open wound infection ($P = 0.02$), steroid use for chronic condition ($P = 0.03$), preoperative transfusion ($P = 0.05$), and emergency cases ($P = 0.02$).

Table 5 displays the results of the three propensity matched logistic regression models predicting the likelihood of experiencing the two postoperative adverse events. Patients who were classified as having thrombocytopenia had similar odds ratios among the two adverse events when compared to the normal group: return to the operating room (OR 1.25; 95% CI 0.88, 1.78; $P = 0.21$) and surgical site infection (OR 1.20; 95% CI 0.66, 2.18; $P = 0.55$). The results obtained from the propensity match showed no significant difference in adverse outcome based upon preoperative platelet count, validating the results of the multivariate analysis. The results of the adjusted odds ratio obtained from models 2 and 3 were similar to the unadjusted odds ratio obtained from model 1.

Discussion

This retrospective study was performed to determine whether low platelet count is an independent predictor of postoperative adverse outcomes following lumbar microdiscectomy. Prior studies have shown the relationship of abnormal platelet values and postoperative burden in both spine and non-spine cases [11–13]. The mechanisms behind thrombocytopenia include inability to produce adequate amounts of platelets or pathology associated with dysfunctional platelets [14]. This phenomenon may lead to increased susceptibility to bleeding, infection, and improper wound repair. After adjusting for confounders in the multivariate stepwise analyses and propensity matched models, we found no significant differences in the postoperative outcomes of interest as a function of preoperative platelet count. However, patient characteristics and comorbidities including diabetes, current smoking, wound infection, and emergency status remained influential in our multivariate models.

In our study, diabetes was associated with a 1.36 greater probability of returning to the operating room. This finding is consistent with previous studies that have shown uncontrolled diabetes to worsen surgical outcomes and functional recovery of the spinal cord in patients with cervical myelopathy [15,16]. Wolfson et al. 2013 [17] found that patients with diabetes undergo more frequent procedures and experience more frequent complications such as infection and failure of operation from sports medicine procedures. The increased degree of oxidative stress and vascular abnormalities caused by chronic hyperglycemia may explain the vulnerability to postoperative complications seen in lumbar microdiscectomy.

Smoking was also found to be a predictor for postoperative adverse outcomes. Patients who were current smokers had a 47% increase in the odds of experiencing a return to the operating room and 99% increased odds of experiencing a surgical site infection. Patients who are smokers are more prone to surgical site infections, postoperative wound complications, and pseudarthrosis following spine surgery [18,19]. Proper counseling and smoking cessation should be established prior to spine surgery to reduce the occurrence of complications and costs of adverse perioperative events [20].

Another significant predictor of adverse outcomes was emergency status. Multivariate analyses showed this had an odds ratio of 2.50 for experiencing a return to the operating room. Studies have reported as-

Table 1
Patient demographics, health history, and comorbidities.

Characteristics	All Patients N = 64,747		Severe Thrombocytopenia ≤100N = 324(0.5%)	Thrombocytopenia 101-150N = 2256(3.5%)	Moderate 151-199N = 11,624(18.0%)	Normal 200-450N = 50,543(78.1%)	ANOVAP-value					
Demographics												
Age in years, Mean (SD)	Median (IQR)	52.3 (15.7)	52.0 (40.0, 65.0)	58.8 (14.8)	59.0 (48.0, 71.0)	60.5 (15.2)	63.0 (51.0, 72.0)	65.5 (16.0)	57.0 (43.0, 68.0)	51.1 (15.4)	51.0 (39.0, 63.0)	<0.0001
Age categorized,												
	18-35	10,904 (16.8%)		20 (6.2%)	198 (8.8%)		1549 (13.3%)		9137 (18.1%)			<0.0001
	36-65	38,836 (60.0%)		190 (58.6%)	1089 (48.3%)		6471 (55.7%)		31,086 (61.5%)			
	>65	15,007 (23.2%)		114 (35.2%)	969 (43.0%)		3604 (31.0%)		10,320 (20.4%)			
Sex, n (%)												
	Male	36,002 (55.6%)		219 (67.6%)	1757 (77.9%)		8323 (71.6%)		25,703 (50.9%)			<0.0001
	Female	28,737 (44.4%)		105 (32.4%)	499 (22.1%)		3299 (28.4%)		24,834 (49.1%)			
Race, n (%)												
	Unknown/Not reported	7655 (11.8%)		58 (17.9%)	254 (11.3%)		1421 (12.2%)		5922 (11.7%)			
	American Indian or Alaska Native	357 (0.6%)		2 (0.6%)	5 (0.2%)		41 (0.4%)		309 (0.6%)			
	Asian	1558 (2.4%)		7 (2.2%)	51 (2.3%)		245 (2.1%)		1255 (2.5%)			<0.0001
	Black or African American	4299 (6.6%)		22 (6.8%)	152 (6.7%)		700 (6.0%)		3425 (6.8%)			
	Native Hawaiian or Pacific Island	184 (0.3%)		0 (0%)	0 (0%)		23 (0.2%)		161 (0.3%)			
	White	50,694 (78.3%)		235 (72.5%)	1794 (79.5%)		9194 (79.1%)		39,471 (78.1%)			
	Smoker, n (%)	14,459 (22.3%)		75 (23.1%)	422 (18.7%)		2300 (19.8%)		11,662 (23.1%)			<0.0001
Comorbidities, n (%)												
	Diabetes	9295 (14.4%)		87 (26.9%)	466 (20.7%)		1844 (15.9%)		6898 (13.6%)			<0.0001
	Dyspnea	2022 (3.1%)		26 (8.0%)	104 (4.6%)		390 (3.4%)		1502 (3.0%)			<0.0001
	Ventilator	7 (0.01%)		1 (0.3%)	0 (0%)		1 (0.01%)		5 (0.01%)			0.06
	Severe COPD	1695 (2.6%)		8 (2.5%)	94 (4.2%)		346 (3.0%)		1247 (2.5%)			<0.0001
	Ascites	6 (0.01%)		2 (0.6%)	1 (0.04%)		1 (0.01%)		2 (0%)			<0.0001
	Congestive heart failure	121 (0.2%)		0 (0%)	12 (0.5%)		36 (0.3%)		73 (0.1%)			<0.0001
	Hypertension, medication required	26,047 (40.2%)		162 (50.0%)	1206 (53.5%)		5170 (44.5%)		19,509 (38.6%)			<0.0001
	Disseminated cancer	127 (0.2%)		5 (1.5%)	17 (0.8%)		29 (0.2%)		76 (0.2%)			<0.0001

(continued on next page)

Table 1 (continued)

Characteristics	All Patients N = 64,747	Severe Thrombocytopenia ≤100N = 324(0.5%)	Thrombocytopenia 101-150N = 2256(3.5%)	Moderate 151-199N = 11,624(18.0%)	Normal 200-450N = 50,543(78.1%)	ANOVAP-value
Health History						
Steroid use for chronic condition, n (%)	2357 (3.6%)	18 (5.6%)	122 (5.4%)	431 (3.7%)	1786 (3.5%)	<0.0001
>10% loss body weight in last 6 months, n (%)	130 (0.2%)	1 (0.3%)	8 (0.4%)	27 (0.2%)	94 (0.2%)	0.16
Bleeding disorder, n (%)	718 (1.1%)	55 (17.0%)	119 (5.3%)	162 (1.4%)	382 (0.8%)	<0.0001
ASA Classification, n (%)						
I	6110 (9.4%)	11 (3.4%)	130 (5.8%)	1048 (9.0%)	4921 (9.7%)	
II	36,792 (56.8%)	103 (31.8%)	981 (43.5%)	6228 (53.6%)	29,480 (58.3%)	
III	20,837 (32.2%)	190 (58.6%)	1058 (46.9%)	4109 (35.3%)	15,480 (30.6%)	0.001
IV	939 (1.5%)	20 (6.2%)	84 (3.7%)	223 (1.9%)	612 (1.2%)	
Pre-operative transfusion	24 (0.04%)	4 (1.2%)	4 (0.2%)	3 (0.03%)	13 (0.03%)	<0.0001
Surgery Characteristic						
Operation Time in minutes,			<0.0001			
Mean (SD)	94.3 (57.3)	99.7 (56.5)	102.3 (62.5)	96.5 (59.5)	93.4 (56.5)	
Median (IQR)	81.0 (59.0, 113.0)	86.5 (60.0, 121.0)	86.0 (62.0, 124.0)	82.0 (60.0, 116.0)	80.0 (58.0, 112.0)	

Boldface *P* value indicates significant differences in pairwise comparisons between Severe Thrombocytopenia vs Normal and Thrombocytopenia vs Normal at $P < 0.05$.

Thrombocytopenia = thrombocytopenia

ASA = American Society of Anesthesiologists

COPD = chronic obstructive pulmonary disease

SD = standard deviation

IQR = interquartile range

Table 2
Univariate logistic regression predicting odds of experiencing postoperative adverse outcomes.

Characteristic	Return to Operating Room		Surgical Site Infection	
	Odds ratio (95% CI)	P-value	Odds ratio (95% CI)	P-value
Pre-operative Platelet Status	2.17 (1.29, 3.66)	0.004	3.25 (1.60, 6.60)	0.001
Severe Thrombocytopen.				
Thrombocytopen.	1.16 (0.89, 1.52)	0.28	0.92 (0.56, 1.51)	0.73
151-199	1.01 (0.88, 1.16)	0.91	0.89 (0.70, 1.13)	0.34
Normal	1.00	–	1.00	–
Sex				
Female	1.17 (1.06, 1.30)	0.003	–	–
Male	1.00			
Diabetes				
	1.44 (1.26, 1.65)	<0.0001	1.52 (1.22, 1.89)	0.0002
Current Smoker				
	1.22 (1.08, 1.37)	0.001	1.80 (1.49, 2.17)	<0.0001
Dyspnea				
	1.37 (1.05, 1.78)	0.02	–	–
Severe COPD				
	1.62 (1.24, 2.11)	0.0004	1.74 (1.13, 2.68)	0.01
Ascites				
	22.1 (4.05, 120.9)	0.0004	–	–
Hypertension with medication required				
	1.20 (1.08, 1.34)	0.001	–	–
Disseminated Cancer				
	3.39 (1.72, 6.68)	0.0004	–	–
Wound infection				
	3.84 (2.12, 6.94)	<0.0001	–	–
Steroid Use				
	1.52 (1.20, 1.92)	0.0004	–	–
Bleeding disorder				
	1.67 (1.13, 2.48)	0.01	2.24 (1.26, 3.98)	0.01
ASA Classification				
I	1.00		1.00	
II	1.09 (0.89, 1.34)		1.15 (0.80, 1.65)	
III	1.55 (1.26, 1.90)	<0.0001	1.78 (1.24, 2.57)	<0.0001
IV	2.20 (1.50, 3.22)		3.49 (1.96, 6.21)	
Emergency Case				
	2.27 (1.80, 2.87)	<0.0001	1.89 (1.24, 2.88)	0.003

Thrombocytopen.= thrombocytopenia.

–indicates variables that were not included in the univariate analysis for the adverse event.

Table 3
Multivariate stepwise logistic regression for predicting odds of experiencing postoperative adverse outcomes.

Characteristic	Return to Operating Room		Surgical Site Infection	
	Adjusted OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value
Diabetes				
	1.36 (1.12, 1.65)	0.002	–	–
Current Smoker				
	1.47 (1.23, 1.76)	<0.0001	1.99 (1.47, 2.68)	<0.0001
Wound infection				
	–	–	–	–
Emergency status				
	2.50 (1.76, 3.49)	<0.0001	–	–

–indicates variables the were not statistically significant.

OR= odds ratio.

sociations of emergency patients with postoperative complications related to pain, respiratory, and wound issues [21,22]. Additional information is needed to explain the increased risk of poor health outcomes related to emergency status which may be caused by referred admission on non-trauma emergency surgical cases and surgical delays [23,24].

The standard lumbar microdiscectomy is generally considered low risk with short operating times and minimal perioperative and intra-operative complications [1,25]. Ryang et al. 2008 [26] found an average blood loss of 63.8± 86.8mL for a standard lumbar microdiscectomy, which is minimal compared with average blood losses greater than 500mL in patients with spinal deformities undergoing posterior

lumbar fusion [27,28]. The increased blood loss seen in more complex procedures may be compounded by abnormal platelet counts as seen in similar studies assessing multiple spine surgeries [5,6]. Malpani et al. 2020 demonstrated that thrombocytopenia did independently correlate to adverse outcomes following lumbar surgery [6], which is contrary to the data presented in this manuscript. That said, the study included a heterogenous sample of spinal procedures, including many procedures more invasive than lumbar microdiscectomy. Thus, the results may not be generalizable to microdiscectomy.

There are some limitations of this retrospective study. We isolated only two adverse events of critical surgical interest: unplanned reoperation and surgical site infection. These were chosen as they were felt

Table 4
Comparison of patient demographic, health history, and comorbidities before and after propensity matching.

Characteristics	Before Propensity Matching				d	After Propensity Matching				d	
	Thrombocytopenia N = 2580 (4.0%)		Normal N = 62,167 (96.0%)			Thrombocytopenia N = 2540 (50.0%)		Normal N = 2540 (50.0%)			
Demographics											
Age in years, Mean (SD)	Median (IQR)	60.3 (15.1)	63.0 (51.0, 72.0)	51.9 (15.6)	52.0 (40.0, 64.0)	0.55 ^a	60.3 (15.1)	62.0 (51.0, 72.0)	60.3 (15.1)	62.0 (51.0, 72.0)	0.00
Sex, n (%)											
Male		1976 (76.6%)		34,026 (54.7%)		0.47 ^a	1954 (76.9%)		1954 (76.9%)		0.00
Female		604 (23.4%)		28,133 (45.3%)			586 (23.1%)		586 (23.1%)		
Comorbidities											
Diabetes, n (%)		553 (21.4%)		8742 (14.1%)		0.19 ^a	539 (21.2%)		539 (21.2%)		0.00
Smoke, n (%)		497 (19.3%)		13,962 (22.5%)		0.08	488 (19.2%)		493 (19.4%)		0.01
Dyspnea, n (%)		130 (5.0%)		1892 (3.0%)		0.10 ^a	117 (4.6%)		117 (4.6%)		0.00
Severe COPD, n (%)		102 (4.0%)		1593 (2.6%)		0.08	100 (3.9%)		98 (3.9%)		0.00
Congestive heart failure, n (%)		12 (0.5%)		109 (0.2%)		0.05	12 (0.5%)		12 (0.5%)		0.00
Ascites, n (%)		3 (0.1%)		3 (0%)		0.05	3 (0.1%)		1 (0.04%)		0.03
Hypertension with medication required, n (%)		1368 (53.0%)		24,679 (39.7%)		0.27 ^a	1352 (53.2%)		1352 (53.2%)		0.00
Renal Failure, n (%)		6 (0.2%)		27 (0.04%)		0.05	3 (0.1%)		1 (0.04%)		0.03
Disseminated Cancer, n (%)		22 (0.9%)		105 (0.2%)		0.10 ^a	9 (0.4%)		9 (0.4%)		0.00
Health History											
Open wound/wound infection, n (%)		12 (0.5%)		139 (0.2%)		0.04	12 (0.5%)		9 (0.4%)		0.02
Steroid use for chronic condition, n (%)		140 (5.4%)		2217 (3.6%)		0.09	136 (5.4%)		117 (4.6%)		0.03
Bleeding disorder, n (%)		174 (6.7%)		544 (0.9%)		0.31 ^a	145 (5.7%)		145 (5.7%)		0.00
ASA Classification, n (%)											
I		141 (5.5%)		5969 (9.6%)		0.16	140 (5.5%)		140 (5.5%)		0.00
II		1084 (42.0%)		35,708 (57.4%)		0.31	1073 (42.2%)		1073 (42.2%)		0.00
III		1248 (48.4%)		19,589 (31.5%)		0.35	1235 (48.6%)		1235 (48.6%)		0.00
IV		104 (4.0%)		835 (1.3%)		0.17	89 (3.5%)		89 (3.5%)		0.00
Pre-operative transfusion, n (%)		8 (0.3%)		16 (0.03%)		0.07	7 (0.3%)		2 (0.1%)		0.05
Pre-operative WBC, mean (SD)		6.5 (2.58)		7.8 (2.61)		0.50	6.5 (2.58)		7.7 (2.72)		0.45
Pre-operative hematocrit, mean (SD)		41.6 (4.97)		42.0 (4.21)		0.09	41.6 (4.91)		42.4 (4.33)		0.17
Ventilator		1 (0.04%)		6 (0.01%)		0.02	1 (0.04%)		0 (0%)		0.03
Emergency Case		69 (2.7%)		1572 (2.5%)		0.01	67 (2.6%)		61 (2.4%)		0.02

^a Matched variables with unbalanced standardized differences greater than 10%.

Table 5
Logistic regression models predicting the odds of experiencing postoperative adverse outcomes in propensity matched groups.

	Model 1 ^a		Model 2 ^b		Model 3 ^c	
	Odds ratio (95% CI)	P-value	Odds ratio (95% CI)	P-value	Odds ratio (95% CI)	P-value
Return to Operating Room						
Thrombocytopenia	1.25 (0.88, 1.78)	0.21	1.25 (0.88, 1.79)	0.21	1.26 (0.87, 1.83)	0.22
Normal	1.00		1.00		1.00	
Surgical Site Infection						
Thrombocytopenia	1.20 (0.66, 2.18)	0.55	1.20 (0.66, 2.19)	0.55	1.33 (0.72, 2.46)	0.36
Normal	1.00		1.00		1.00	

^a Model 1 is the unadjusted model.

^b Model 2 controls for matching variables (i.e. age, sex, diabetes, dyspnea, hypertension with medication required, disseminated cancer, bleeding disorder, and ASA classification).

^c Model 3 controls for matching variables and possible confounders (i.e. pre-operative WBC and pre-operative hematocrit lab values).

to be the most specifically relevant issues when planning surgical risks during surgical indication. Evaluation of additional secondary outcomes would have been of interest, and further work should be done to ensure thrombocytopenia does not independently increase the risk for other adverse postoperative outcomes. Additionally, the postoperative data does not extend beyond a 30-day time frame. The NSQIP database restricts site-specific details which would better inform us on resource availability, access to specialized care, and population specific demographics. Additionally, the data does not measure spine specific outcomes such as pain or disability scores. Lastly, the retrospective nature of the database prevents analysis of other potential outcomes of interest in this population.

Conclusion

This study reports that thrombocytopenia is not an independent predictor for adverse postoperative outcomes following lumbar microdiscectomy. Multivariate stepwise logistic regression and propensity matched analyses showed no significant differences between platelet counts and our adverse outcomes of interest – return to the operating room and surgical site infection. Comorbidities including diabetes, current smoker, wound infection, and emergency status were more likely to predict poor postoperative outcomes when controlling for other variables and confounders. The shorter duration and decreased blood loss experienced in lumbar microdiscectomy may attenuate the postoperative complications normally seen in patients with abnormal platelet counts who undergo complex procedures.

Declarations of Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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