

## Postoperative Ketamine May Increase Risk of VTE in Chronic Opioid Users After Spine Surgery

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### INTRODUCTION

Venous thromboembolic events (VTE) are a serious adverse event after surgery that affects anywhere from 0.29 – 31% of patients after spine surgery. Risk factors and prophylaxis have been well-characterized in other specialty fields of orthopaedics, specifically hip and knee arthroplasty, but research is not as robust in spine. Although numerous risk factors for VTE exist in the literature, little exists on the impact of opioid use and postoperative pain management on VTE risk. Opioid use is especially prevalent in patients undergoing spine surgery, with at least 20% of patients reporting taking opioids leading up to surgery. Although recent literature has shown perioperative ketamine can reduce opioid consumption postoperatively, there is scarce literature on postoperative ketamine use and its impact on complications after spine surgery. The aim of this study was to assess the risk of VTE in chronic opioid users undergoing spine surgery, particularly those who received postoperative ketamine for pain management.

### METHODS

After Institutional Review Board approval, we conducted a structured query language (SQL) search to identify patients with diagnosis of venous thromboembolism (VTE) after spine surgery from 2017-2021 at a single, urban, tertiary care center. Chart review was performed to confirm patient demographics, surgical details, surgical outcomes, and postoperative ketamine use. Opioid use was identified using the Prescription Drug Monitoring Program (PDMP) for each patient. Chronic opioid users were defined as having >182 days or >9 opioid prescriptions prescribed in the 12 months before surgery, following guidelines from the CDC and other recent spine literature. Statistical analysis was performed to compare patients with VTE after spine surgery to patients without VTE. A 3:1 propensity match of the two groups was then performed utilizing age, BMI, race, sex, and levels fused.

### RESULTS

328 total patients were identified with complete PDMP and postoperative ketamine data, including 33 patients with confirmed VTE after spine surgery. Patients in the VTE group had significantly longer OR times (258 vs. 192 minutes,  $p=0.009$ ) than patients in the no VTE group. Additional surgery (1.36% vs. 9.09%  $p=0.025$ ) and takeback for infection (0.68% vs. 9.09%,  $p=0.008$ ) were also significantly associated with the VTE group. Bivariate analysis of postoperative ketamine use found significant association with VTE occurrence after surgery (15.2% vs. 4.07%,  $p=0.019$ ). Chronic opioid users were similarly distributed between the VTE and no VTE group (36.4% vs. 24.1%,  $p=0.184$ ). After matching, postoperative ketamine (6.06% vs. 15.2%,  $p=0.141$ ) and chronic opioid users (25.3% vs. 36.4%,  $p=0.314$ ) were found to be similar between the VTE and no VTE groups.

### DISCUSSION

Risk factors for VTE have been a significant subject of research in orthopaedics over recent years. Cancer, a risk factor associated with VTE in all clinical settings, has been validated as a risk factor VTE in spine surgery. Various nationwide database have also identified numerous factors as having an impact on VTE occurrence after spine surgery, including thoracolumbar surgery, advanced age, prolonged length of stay, disposition to institutional care, coagulation disorders. Our study found chronic opioid users did not have significantly higher rates of VTE but those that received postoperative ketamine for pain management had significantly higher rates of VTE. However, this significance dropped out in the matched cohort analysis.

Limitations of this study include those inherent to a retrospective study, including selection bias. Due to the small number of VTEs found in our search from 2017-2021, our study is underpowered to detect a difference between the two groups after propensity matching. Additionally, selecting patients in the no VTE group was decided by availability of PDMP and postoperative ketamine data that could have introduced further selection bias into our study.

Our study found that postoperative ketamine was significantly associated with VTE in patients undergoing spine surgery, which subsequently fell out in our matched analysis due to our study being underpowered. Future research should investigate potential complications from postoperative ketamine as part of pain management after spine surgery.

### SIGNIFICANCE/CLINICAL RELEVANCE

Recent alternative methods of postoperative pain management, including ketamine, have become increasingly popular in attempts to reduce postoperative opioid consumption. We observe that postoperative ketamine may have unintended effects on outcomes, such as increase in VTE after spine surgery.

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### TABLES:

Opioid and Postoperative Ketamine Use

	No VTE	VTE	P Value
Postoperative Ketamine			0.019*
No	283 (95.9%)	28 (84.8%)	
Yes	12 (4.07%)	5 (15.2%)	
Chronic Opioid Users			0.184
No	224 (75.9%)	21 (63.6%)	
Yes	71 (24.1%)	12 (36.4%)	
Chronic Days Opioid 1yr	116 (172)	110 (176)	0.981
Chronic # Prescriptions 1yr	5.55 (6.86)	5.93 (6.83)	0.667
1 Year Pre Op MME	283 (610)	467 (1351)	0.248