

Risk Factors for Postoperative Urinary Retention after Lumbar Fusion Surgery: Anesthetics and Surgical Approach

Jeremy C Heard, Yunsoo Lee¹, Teeto Ezeonu, Mark Lambrechts, Azra Nicolle Dees, Bright Mensah Wiafe, Gregory Toci¹, Eric Stephen Schwenk, Jose Antonio Canseco², Ian Kaye, Léo Fradet³, Colleen Wixted, Alexander Vaccaro, Gregory Douglas Schroeder, Christopher Kepler

¹Rothman Orthopaedic Institute, ²Rothman Orthopaedic Institute/Thomas Jefferson Uni, ³Philomec S.E.N.C.

INTRODUCTION:

Prior studies have identified risk factors for postoperative urinary retention (POUR) after spine surgery, including recent studies that have implicated anesthetic medications. A recent meta-analysis identified advanced age, male gender, a history of benign prostatic hyperplasia, diabetes mellitus, more levels involved, a longer surgical time, and a history of urinary tract infection to be predictive of POUR following elective spine surgery. However, there is still a lack of consensus on the impact of certain anesthetic reversal agents and surgical approaches on POUR development. In particular, glycopyrrolate, neostigmine, and sugammadex have demonstrated varying associations with POUR and studies have recommended the need for additional research on the impact of these medications. Another topic that is not well discussed in the spine surgery literature is the impact of surgical approach on POUR. Given that an anterior approach to lumbar fusion is more prone to disruption of structures involved in bladder control, it is plausible that patients undergoing anterior lumbar surgery are more likely to experience POUR than those with a posterior approach alone. Consequently, there is a need for further research on the impact of an anterior versus posterior lumbar approach on POUR. Therefore, we aimed to determine the relationship between POUR and 1) surgical approach and 2) anesthetic agents, including sugammadex and glycopyrrolate.

METHODS: After IRB approval, L4-S1 single-level lumbar fusion surgeries (including posterolateral lumbar decompression and fusion (PLDF), transforaminal lumbar interbody fusion (TLIF), and anterior lumbar interbody fusion (ALIF)) between 2018-2021 were identified. A 3:1 propensity match of patients with POUR to those without was conducted, controlling for patient age, sex, diabetes status, body mass index, smoking status, history of BPH, and the number of levels decompressed. POUR was defined as documented straight catheterization yielding >400mL. We compared patient demographics and surgical characteristics, anesthetic, and postoperative characteristics. The postoperative characteristics collected included complications (UTI, blood loss anemia, hypotension, ileus, other), day of bladder catheter (Foley) removal, postoperative ambulation measured by distance (feet) walked during postoperative day 1 with physical therapy, inpatient opioid administration (milligram morphine equivalents (MME)), and length of stay (days). A bivariate analysis and backward multivariable stepwise logistic regression analysis (p-value < 0.200) were performed. Significance was set to p<0.05.

RESULTS: Of the 899 patients identified, 51 met the criteria for POUR and were matched to 153 patients. There were no significant differences between groups based on demographic or surgical characteristics. On bivariate analysis, patients who developed POUR were more likely to have been given succinylcholine (13.7% vs. 3.92%, p=0.020) as an induction agent. However, the use of other anesthetic agents, including midazolam (81.7% vs. 84.3%, p=0.832), rocuronium (97.4% vs. 100%, p=0.574), and propofol (99.3% vs. 98.0%, p=0.438), did not yield a significant difference between groups. Patients with POUR were more likely to have a postoperative course complicated by a UTI (7.84% vs. 0.00%, p=0.004). In addition, patients with POUR were more likely to have walked a shorter distance at postoperative day 1 (68.0 ± 111 vs. 116 ± 141 feet, p=0.001) and have an increased postoperative length of stay (3.80 ± 2.86 vs. 4.59 ± 2.68, p<0.001). The independent predictors of POUR identified by multivariable analysis included the use of succinylcholine (odds ratio (OR): 4.37 [confidence interval (CI): 1.26-16.46], p=0.022) and reduced postoperative activity (OR: 0.99 [CI: 0.993-0.999], p=0.049). Factors protective against POUR included using sugammadex as a reversal agent (OR: 0.38 [CI: 0.17-0.82], p=0.017). The stepwise regression did not identify an anterior surgical approach as a significant predictor of POUR (**Table 1**).

DISCUSSION AND CONCLUSION: Postoperative urinary retention is a common and costly postoperative complication after lumbar fusion surgery. Several studies have assessed the association between neostigmine, glycopyrrolate, sugammadex, and POUR without demonstrating consistent results. Our study adds to the literature by being the first to demonstrate that sugammadex is protective against POUR after spinal fusion surgery. Therefore, to avoid the ramifications associated with POUR, the use of sugammadex should be considered over other reversal agents after lumbar fusion surgery. While our study found that the use of succinylcholine was significantly associated with POUR, there is little literature assessing the association between succinylcholine and POUR. Further study is needed into the effect of succinylcholine, but based on our results, it may be prudent to consider other nondepolarizing induction agents. Few studies have assessed the impact of the surgical approach to lumbar spinal fusion on POUR and are often limited by enrollment. Our study, in which 22.9% of patients had an ALIF, expands upon this topic and demonstrates that an ALIF is not more associated with POUR than a TLIF or PLDF.

Table 1: Backwards stepwise multivariant logistic regression analysis assessing for association with POUR

Variable	Estimate	P Value	Odds Ratio	Lower 95	Upper 95
Propofol Infusion	-1.99	0.067	0.14	0.01	0.77
Succinylcholine	1.47	0.022*	4.37	1.26	16.46
Sugammadex	-0.96	0.017*	0.38	0.17	0.82
Post Op Activity	-0.003	0.049*	0.99	0.993	0.999