

Intraoperative Factors and Risk of Manipulation Under Anesthesia After Primary Total Knee Arthroplasty

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Disclosures: None

Introduction: Postoperative stiffness requiring manipulation under anesthesia (MUA) is a challenging complication following total knee arthroplasty (TKA). While previous studies have established that patient-level risk factors like limited preoperative range of motion and obesity are associated with postoperative stiffness, the influence of intraoperative variables remains incompletely assessed. We examined whether tourniquet use, anesthesia type, postoperative nerve block utilization, resident involvement, and preprocedure corticosteroid use are associated with MUA following primary TKA.

Methods: Following institutional review board approval, we completed a single-center cohort study of 400 primary TKAs performed at a single institution from 2017 to 2019. Unicompartmental procedures, revisions, implant removals, and patients with less than 90 days of follow up were excluded. For each patient meeting inclusion criteria, demographic and comorbidity data were collected as well as tourniquet usage, anesthesia type, postoperative nerve block utilization, resident involvement, and corticosteroid injection within 12 weeks of primary TKA. The primary outcome was MUA within 16 weeks of the primary TKA, with secondary outcomes including infection, revision, and unplanned postoperative visits to an orthopedic clinic, urgent care center, or emergency department. Missing data were multiply imputed, and patients were propensity-score matched for each exposure. Risk ratios and odds ratios were estimated using regression models robust to sparse events. False discovery rate correction was applied for multiple testing. Post-match balance diagnostics were examined to confirm adequate comparability between exposure groups.

Results: Of the 243 patients who met inclusion criteria, 162 (66.7%) were female. 14 (5.8%) underwent MUA within 16 weeks. None of the intraoperative factors studied - including tourniquet use, spinal vs general anesthesia, postoperative nerve block, resident involvement, or preprocedure corticosteroid injection - were significantly associated with MUA (Table 1). A nominal signal suggested reduced infection risk with spinal anesthesia (OR 0.04, 95% CI 0.00–0.75; p=0.031), but this did not persist after correction for multiple testing (q=1.00).

Discussion: In this propensity-matched, mutually imputed cohort, there is evidence that intraoperative decisions do not always influence stiffness outcomes after primary TKA. These findings reinforce the growing evidence that prevention of MUA may depend more on patient-specific characteristics like preoperative range of motion, comorbidities, and adherence to rehabilitation than intraoperative variation. Larger multicenter analysis is warranted to better outline these patient-centered determinants. Precision was limited for several exposures because of small effective matched samples and sparse outcome events, despite residual covariate adjustment.

Significance/Clinical Relevance: Identifying modifiable intraoperative factors that contribute to postoperative stiffness is critical for optimizing functional recovery after TKA. Our findings suggest that commonly debated surgical and anesthetic choices may not meaningfully affect MUA risk, highlighting the greater importance of patient selection, comorbidity management, and tailored rehabilitation in reducing secondary interventions.

Table 1: Intraoperative Variables and Risk of MUA ≤16 Weeks After TKA

Exposure	Effect Measure	Point Estimate	95% CI	P-value
Tourniquet use	OR	0.25	0.01-9.43	0.457
Spinal vs. General Anesthesia	OR	1.14	0.29-4.45	0.854
Postoperative Nerve Block	OR	2.02	0.31-13.24	0.462
Resident Involvement	OR	0.38	0.04-3.72	0.409
Preprocedure Corticosteroid Injection	RR	1.0	0.57-1.75	1.0

Abbreviations: OR = Odds Ratio; RR = Risk Ratio; CI = Confidence Interval