Risk Factors of Opioid Consumption Following Anterior Cruciate Ligament Reconstruction

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INTRODUCTION: Prescription opioid misuse after orthopedic procedures contributes to the opioid epidemic, making prescribing practices a key target for removing opioids from communities. Identifying opioid requirements after orthopedic procedures, and patient characteristics associated with prolonged opioid use, can lead to improved prescribing practices. The objective of this study was to describe opioid use in patients after anterior cruciate ligament reconstruction (ACLR) and identify patient and surgical factors associated with greater opioid consumption.

METHODS: Patients were recruited from a quality improvement initiative with the Michigan Opioid Prescribing Engagement Network at the University of Michigan. This study was granted not regulated status by the institutional review board as data was collected as part of a larger quality improvement initiative (HIM00135796). Patients that underwent ACLR between July 2017 and June 2018 were eligible to participate. Informed consent was obtained, and patients were contacted via telephone. The primary outcome was opioid consumption. Specifically, prescribed opioids were captured in the electronic medical records, and patients were asked to estimate the percentage of prescribed opioids they took following surgery. Demographic and surgical factors were recorded as predictors, including age, gender, race, body mass index, current smoking status, the Area Deprivation Index (ADI), previous opioid use, surgeon, physiotherapy pre- or post-ACLR, the Elixhauser Comorbidity Index (ECI), and postoperative pain (none, minimal, moderate, severe). Mixed-effects multivariable linear regression with backward stepwise selection of covariates was used to determine which predictors were associated with opioid consumption post-ACLR. Predictors were removed one at a time until only predictors with a p-value <0.10 remained. Effect estimates, 95% confidence intervals (CIs), and p-values were presented for the final, simplified model.

RESULTS: Of 313 patients that were contacted by phone for this study, 140 (44.7%) responded and consented to participate. Responders were 54% male with a median age of 20 (range: 8- to 68-years), and telephone interviews occurred at a mean follow-up time of 9-months (range: 4- to 16-months). The median percentage of prescribed opioids consumed was 41.7% (interquartile range: 13.3% to 75.0%), and 12.1% of patients did not consume any opioids. Two patients (1.4%) were still using opioids at 3-months post-surgery. Five predictors, including ADI, smoking status, previous opioid use, postoperative pain level, and surgeon remained in the regression model (p<0.10). Smoking, and moderate or severe pain post-ACLR with significantly associated with greater opioid consumption, while previous opioid use and the practice of one orthopaedic surgeon were associated with significantly reduced opioid consumption (Table 1). While the ADI remained in the model, it was not statistically significantly associated with opioid use (p = 0.05).

DISCUSSION: The most important finding of this study was that greater postoperative pain severity and smoking were associated with greater opioid consumption post-ACLR. Pain severity demonstrated a dose-response relationship with consumption, where patients with greater pain consumed a greater percentage of their prescribed opioids, like previous studies. Multimodal perioperative pain management may be an effective way to reduce opioid use, and preliminary studies have demonstrated some effectiveness, though larger trials are needed. Many studies have targeted physician prescribing practices to reduce opioid consumption and pill diversion, and our findings show that many prescribed opioids are not consumed following ACLR. Research, and legislation, limiting opioid use have demonstrated that prescribing less opioids results in similar outcomes. Thus, clinicians and hospitals should be focused on implementing effective strategies in their own healthcare systems. Interestingly, prior exposure to opioids was associated with less consumption post-ACLR. While our study is unable to determine why this occurred, we hypothesize that patient education regarding the dangers of prolonged opioid use has greatly improved. Patient education is a key pillar of strategies and guidelines to reduce opioid use after orthopaedic procedures. Our study had strengths and weaknesses. Our target population was patients undergoing ACLR, who are often younger than other orthopaedic patients. Young patients have demonstrated increased susceptibility to opioid addiction and risk factors may differ in young patients compared to those middle-aged and older. Our study was limited by retrospective data collection, which may increase the risk of selection bias and recall bias. Our study sample appeared to be representative, and prescription information was well-documented in electronic medical records. Additionally, patients were sampled from one surgical center and the practice of six orthopaedic surgeons, which limits the generalizability of our findings.

SIGNIFICANCE/CLINICAL RELEVANCE: Our study found that less than half of prescribed opioids are consumed post-ACLR, with pain level and surgeon being associated with opioid consumption. Prescribing less opioids, strategies targeting alternative pain management strategies, and physician prescribing practices may effectively reduce opioid use in this population.

TABLES:

Table 1 – Final simplified model after backward stepwise elimination (p<0.10)

Variable	Effect estimate (95% CI)	P-value
Area deprivation index	2.8 (1.4 to 4.2)	0.05
Current smoker	**28.9 (15.8 to 42.0)**	**0.03**
Previous opioid use	**-13.4 (-19.0 to -7.9)**	**0.02**
Postoperative pain		
Severe pain	**36.8 (28.2 to 45.3)**	**<0.001**
Moderate pain	**24.1 (16.0 to 32.2)**	**0.003**
None or minimal pain	(reference)	---
Surgeon 3	**-18.4 (-27.3 to -9.5)**	**0.04**

Bolded text indicates statistical significance; Estimate of model fit (R^2 = 0.21).