Preoperative Opioid Use Predicts Prolonged Postoperative Opioid Use and Inferior Patient Outcomes Following Anterior Cruciate Ligament Reconstruction

Enrico M. Forlenza, B.S., Ophelie Lavoie-Gagne, B.S., Yining Lu, B.A., Matthew R. Cohn, M.D., Elizabeth Chang, B.S., Adam B. Yanke, M.D., Ph.D., Brian J. Cole, M.D., M.B.A., Nikhil N. Verma, M.D., and Brian Forsythe, M.D.

Purpose: (1) To determine patient factors associated with prolonged opioid use following anterior cruciate ligament reconstruction (ACLR) and (2) to evaluate the influence of preoperative opioid use on patient-reported outcomes. **Methods:** Patients who underwent ACLR and used opioids before the perioperative period, which was defined as the window 30 days before 15 days following the index surgery, were designated as preoperative opioid users. Patients who used opioids only in the perioperative period or post-operative period were designated as opioid-naïve. Predictors of opioid use at 6 and 12 months postoperatively and associations between preoperative opioid use and patient outcomes were assessed. **Results:** - After institutional review board approval, we identified 253 patients (225 opioid-naïve and 28 opioid users) who underwent ACLR from 2014 to 2018 at a single institution and had one year follow up (median: 11.6 months; interquartile range [8.9-14.3]). Patients with a history of preoperative opioid use (odds ratio [OR] 3.63, $P = .034$), greater preoperative visual analog scale pain scores (OR 1.32, 95% CI 1.04-1.67; $P = .003$), and greater body mass index (OR 1.09, $P = .018$) were significantly more likely to be taking opioids at 6 months postoperatively. Patients with a perioperative opioid intake of greater than 513 oral morphine equivalents were significantly more likely to continue taking opioids at the 6 month (OR 3.17, $P = .024$) and the 1 year (OR 3.34, $P = .048$) postoperative time points. Patients with preoperative opioid use were significantly less likely to achieve the patient acceptable symptomatic state (PASS) on the International Knee Documentation Committee, Knee Injury and Osteoarthritis Outcome Score (KOOS) Sport, KOOS Joint Replacement, KOOS Pain, KOOS Symptoms, KOOS Quality of Life, and KOOS Activities of Daily Living. **Conclusions:** Preoperative opioid use, body mass index >30, and greater visual analog scale pain scores were predictors of continued opioid use at 6 months postoperatively. Preoperative opioid users were more likely to continue taking opioids, demonstrate significantly worse patient reported outcomes at baseline and 1-year postoperatively, and were less likely to achieve patient acceptable symptomatic state. **Level of Evidence:** Level III, Retrospective Cohort Study

From Rush University Medical Center, Chicago, Illinois, U.S.A.

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Address correspondence to Brian Forsythe, M.D., 1611 W Harrison St., Chicago, IL 60612. E-mail: brian.forsythe@rushortho.com

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The widespread availability and use of opioids has led to a public health epidemic in the United States.[1,2] The use of prescription opioids and related drug overdoses has tripled from 1999 to 2015, with one half of opioid overdose deaths due to prescription opioid analgesics.[3,4] Several studies have demonstrated that being prescribed opioids following a surgical procedure is a major risk factor for chronic opioid dependence and abuse.[5,6] For many patients, the postoperative period is their first interaction with prescription opioids. This is especially concerning for those patients undergoing anterior cruciate ligament reconstruction (ACLR), which is a predominantly young and otherwise-healthy population.[7,8]

Widespread use of opioid pain medications resulted from an effort to treat pain as the fifth vital sign.[9,10] Since physicians have recognized the pattern and implications of overprescription, efforts have been made to limit their use, with some success.[4,11] Specific guidelines regarding the use of opioids have been issued by various health care organizations, including the American Academy of Orthopaedic Surgeons.[11] A critical step in limiting the morbidity related to prescription opioid use in orthopaedic surgery is to identify and understand patient-specific risk factors for prolonged opioid use and misuse.

Preoperative opioid use has also been shown to correlate with suboptimal patient outcomes following a multitude of orthopaedic procedures, including arthroscopic rotator cuff surgery, total knee arthroplasty, total shoulder arthroplasty, and spine surgery.[12-18] Specifically, 3 studies examining patients who underwent total shoulder arthroplasty and rotator cuff repair demonstrated that patients with a history of preoperative opioid use do not achieve the same peak outcome scores as their counterparts without a history of opioid use.[14,16,19] The impact of preoperative opioid use on outcomes following ACLR can be further elucidated. The purposes of this study were (1) to determine patient factors associated with prolonged opioid use following ACLR and (2) to evaluate the influence of preoperative opioid use on patient reported outcomes. We hypothesized that preoperative opioid use would be a significant risk factor for prolonged postoperative opioid use and inferior patient outcomes.

Methods

Patient Selection

After institutional review board approval, patients who underwent ACLR between 2014 and 2018 at a single institution were identified using Current Procedural Terminology code 29888. Patients who had an additional surgery in the year prior or following the index operation who required pain control with prescription opioids, who had incomplete data, or who were identified as not undergoing ACLR upon further review of their electronic health record were excluded. Opioid prescription history was obtained through the Illinois Prescription Monitoring Database and verified by cross-reference of each patient's electronic health record. Postoperatively, patients were prescribed a combination of opioid pain medications (5 mg hydrocodone-325 mg acetaminophen, range 30-60 tablets) and nonsteroidal anti-inflammatory drugs during the first postoperative week. After the first 2 days, patients were encouraged to lengthen the time between opioid dosing and transition to nonsteroidal anti-inflammatory drugs . There were no state laws limiting opioid prescribing patterns during the study period. Patients who used opioids during the year before the perioperative period, which was defined as the window 30 days before 15 days following the index surgery, were designated as preoperative opioid users (OUs). Patients who used opioids only in the perioperative period or postoperative period were designated as opioid-naïve (N-OU). Patients who only used opioids within 30 days before surgery were classified as N-OU to account for patients who may have received opioid prescriptions as part of their preoperative management.[20] The Centers for Disease Control and Prevention defines long-term opioid therapy as $\geq$60 days of opioid use within a quarter.[21] However, most patients undergoing ACLR are relatively young and healthy and should otherwise not require opioid medications. As such, OU was classified as use at any time point before the 30 days before surgery.

Postoperative Outcome Measures

Total oral morphine equivalents (OMEs) prescribed were calculated for each of the following time windows: 30 days before 15 days following surgery (defined as perioperative period), 4 to 8 months (defined as the 6-month period), and 10 to 14 months (defined as the 1-year period). Total OMEs were calculated by multiplying the total dose of opioid prescribed by the drug-specific morphine equivalency factor. Results from validated patient-reported outcome measures including the International Knee Documentation Committee (IKDC) questionnaire, the Knee Injury and Osteoarthritis Outcome Score (KOOS) questionnaires for function in sport and recreation (Sport), Pain, Symptoms, Knee-related Quality of Life (QoL), Joint Replacement, and Physical Function Shortform (PS) and function in activities of daily living (ADL), completed by all patients at the preoperative and 1-year follow up time points, were analyzed. Threshold postoperative patient-reported outcome measures scores indicating patient acceptable symptomatic state (PASS) were defined via a validated anchor-based approach, which used patient's "yes" or "no" responses to the question "Taking into account all activities you have done during your daily life, your level of pain, and your functional impairment, do you consider that your current state is satisfactory?" These values are provided in Appendix Table 1, available at www.arthroscopyjournal.org.

Table 1. Patient Demographics and Comorbidities

	All Patients	N-OU	OU	Unadjusted *P* Value $_{OU\ v\ N\text{-}OU}$	Adjusted *P* Value $_{OU\ v\ N\text{-}OU}$
Overall, n (%) or mean (±SD)	253	225	28		
Demographics					
Age, y	36.15 ± 14.70	35.3 ± 14.63	42.9 ± 13.08	**.01**	.80
Male sex	129 (50.9)	116 (51.6)	14 (50.0)	1	
BMI	27.60 ± 6.31	27.3 ± 5.99	30.2 ± 8.11	.21	.89
Modified Charlson Comorbidity Index	0.75 ± 0.94	0.64 ± 0.87	0.96 ± 0.92	.07	.91
Smoking				.05	.89
Former	26 (10.4)	18 (9.3)	6 (25.0)		
Current	6 (2.4)	4 (2.1)	1 (4.2)		
Alcohol consumption	148 (58.5)	135 (60.0)	13 (46.4)	.38	.99
Regular exercise	224 (89.2)	205 (91.1)	21 (75.0)	**.02**	.99
Reconstruction technique				.94	.99
Anteromedial	173 (68.5)	162 (72.2)	17 (60.0)		
Transtibial	80 (31.5)	63 (27.8)	11 (40.0)		
Graft type				.33	.99
Autograft	134 (53.0)	141 (62.7)	9 (33.3)		
Allograft	119 (47.0)	84 (37.3)	19 (66.7)		

NOTE. Boldface indicates statistical significance.
N-OU, opioid-naïve; OU, opioid user.

Statistical Analysis

Patient demographics including age, sex, body mass index (BMI), Charlson Comorbidity Index, tobacco use, alcohol consumption, exercise engagement, opioid use, patient outcome scores, and operative variables, including graft type and reconstruction technique, were collected and differences between N-OU and OU cohorts were assessed by univariate testing. These factors were selected as they have been identified by previous investigations as predictors of postoperative outcomes.[14-16,19,22-24] Predictors of opioid use at 6 and 12 months postoperatively were assessed by bivariate and multivariate logistic regressions. Univariate and multivariate regressions were used to determine associations between preoperative opioid use and patient outcomes while controlling for age, sex, BMI, and comorbid conditions. Comparisons between patient outcome scores were made by Mann−Whitney *U* tests. A perioperative OME cutoff that predicted postoperative use was obtained using receiver operating characteristic (ROC) curve analysis. Assumptions for all tests were not violated. Analyses were performed using RStudio (Boston, MA). Statistical significance was defined as $P < .05$. A post-hoc power analysis demonstrated that with the 8 covariates entered into the multivariate linear model and a calculated effect size of 0.4 based on differences in proportions of postoperative opioid users in the N-OU and the OU group, a sample size of 34 total patients were required to achieve a power of 0.8.

Results

Patient Demographic and Operative Characteristics

A total of 253 patients were identified as satisfying the criteria for inclusion; 225 (89%) patients were identified as being N-OU, and 28 (11%) patients were identified as being OU. The demographic and operative characteristics for the 2 groups are summarized in Table 1. The mean age for OU(42.88 ± 13.08) was significantly greater than N-OU (35.3 ± 14.6, $P = .01$), and the percentage of current and formers smokers among the OU group was twice that of N-OU ($P = .05$). The OU cohort was significantly less likely to report that they regularly engaged in exercise compared with the N-OU cohort ($P = .02$). However, following propensity score adjustment, these demographic differences were eliminated (all $P > .05$). Graft type (i.e., autograft vs allograft, $P = .33$) and reconstruction technique (i.e., anteromedial vs transtibial, $P = .94$) were similar between OU and N-OU groups.

Risk Factors for Prolonged Postoperative Opioid Use

Details of perioperative opioid use are provided in Table 2. Opioid use at 6 months and 1 year postoperatively was significantly greater among OU than N-2OU ($P < .001$). Predictors of prolonged postoperative opioid use are outlined in Table 3. Patients with a history of preoperative opioid use (odds ratio [OR] 3.63, 95% confidence interval [CI] 1.11-11.93; $P = .034$), greater preoperative visual analog scale (VAS) pain scores (OR 1.32, 95% CI 1.04-1.67; $P = .003$), and BMI greater than 30 (OR 1.09, 95% CI 1.01-1.17; $P = .018$) were significantly more likely to be taking opioids at 6 months postoperatively. The ROC for VAS pain score demonstrated a preoperative pain score threshold of >62.6, with an area under the curve (AUC) of 0.72 (95% CI 0.61-0.82) that was predictive of opioid use at 6 months postoperatively. ROC analysis yielded a perioperative OMEs of 513 as the cutoff above which patients were more likely to use opioids at 6

Table 2. Perioperative Opioid Use

	N-OU (223)	OU (28)	*P* Value
Opioid type			.73
Hydrocodone	165 (73.9)	19 (67.8)	
Oxycodone	4 (1.8)	–	
Morphine	8 (3.5)	–	
Tramadol	2 (0.9)	4 (14.3)	
Perioperative OME	348.5 ± 255.5	449.6 ± 451.6	.08
Perioperative OME >513	60 (26.9)	7 (25.0)	1.00
Opioid use at 6 mo	7 (3.1)	11 (39.3)	**<.001**
Opioid use at 1 y	4 (1.8)	10 (35.71)	**<.001**

NOTE. Boldface indicates statistical significance.
N-OU, opioid-naïve; OME, oral morphine equivalent; OU, opioid user.

months postoperatively (AUC 0.65, 95% CI 0.52-0.79). OME equivalent of 513 was also found to be a significant predictor of opioid use at the 6 month (OR 3.17, 95% CI 1.04-9.67; $P = .024$) and the 1 year (OR 3.34, 95% CI 1.01-11.03; $P = .048$) postoperative time points on multivariate regression analysis (Table 3).

Outcome Scores

Absolute values for preoperative and 1-year postoperative patient reported scores are reported in Table 4. The OU cohort demonstrated significantly inferior preoperative patient-reported scores across all outcome measures compared with N-OU patients ($P < .001$, Fig 1). At 1-year follow-up, the OU cohort again demonstrated significantly inferior patient-reported scores across all outcome measures, with the exception of the KOOS Joint Replacement ($P < .001$, Fig 2). Of note, N-OU patients experienced a greater increase in their outcome scores than did previous opioid users on the KOOS ADL, KOOS PS, KOOS QoL, and KOOS Sports questionnaires, but this change increase was only significantly different from previous opioid users for the KOOS PS ($P < .05$, Fig 3).

Importantly, following propensity-adjusted multivariate regression, patients with a history of preoperative opioid use were less likely than their nonopioid using counterparts to achieve the PASS on patient reported-outcome measures (Table 5). Patients who were preoperative opioid users had decreased odds of achieving PASS on the IKDC questionnaire (OR 0.27, 95% CI 0.1-0.74; $P = .01$). In addition, preoperative opioid users had decreased odds of achieving PASS on the KOOS questionnaires for function in sport and recreation (Sport) (OR 0.25, 95% CI 0.09-0.69; $P = .007$), Pain (OR 0.31, 95% CI 0.13-0.77; $P = .01$), Symptoms (OR 0.32, 95% CI 0.14-0.69; $P = .01$), knee-related QoL (OR 0.56, 95% CI 0.13-2.51; $P = .005$), and ADL (OR 0.23, 95% CI 0.09-0.58; $P = .008$, Table 6).

Discussion

The principle findings of this investigation are that: (1) perioperative morphine use, defined as any opioid use in the window of 30 days before 15 days following the index surgery, in excess of 513 OME was associated with a significantly increased risk of continued opioid use at 6 and 12 months postoperatively; (2) patients who had a history of preoperative opioid use had lower outcome scores at the final follow-up assessment; and (3) although improvements are to be expected in patients with a history of preoperative use, they are not as likely to achieve PASS after ACLR as patients without a history of preoperative use.

Our data revealed that 7.17% and 5.58% of patients continue taking opioids at 6 and 12 months postoperatively following ACLR. These results are consistent with previous studies that have examined opioid use following ACLR; Anthony et al.[25] found opioid use to be 7.2% at 90 days and 4.7% at 360 days postoperatively, whereas Rao et al.[7] reported that 17.7% and 2.7% of patients were using ≥2 opioid prescriptions during the early and late recovery phase (defined as 0-90 days and 91-360 days postoperatively) . Of note, the mean age of this cohort is older than these and other studies that have examined factors influencing outcomes following ACLR.[7,25]

The effect of preoperative opioid use on postoperative use has been investigated in the context of a variety of sports medicine procedures. Westermann et al.[26] demonstrated that patients who used opioids in the perioperative period used more opioids in the postoperative period following rotator cuff repair. A recent report from Williams et al.[19] found that patients prescribed opioids preoperatively received 1.91 times more opioids and required opioids over a time period 2.73 times longer than opioid-naïve patients. Results from studies by Jildeh et al.[24] and Anthony et al.[25] yielded similar findings; they found that preoperative opioid users consistently required more opioid prescriptions in the postoperative period following meniscal surgery and ACLR, respectively. Cunningham et al.[23] demonstrated preoperative opioid use to be the strongest predictor of postoperative opioid use following hip arthroscopy when compared with other baseline patient and operative factors. This pattern is not limited to the world of sports medicine; greater preoperative opioid use has been shown to correlate with increased rates of opioid dependence at 1 year following spine

Table 3. Predictors of Prolonged Postoperative Opioid Use

	Odds Ratio	95% CI	*P* Value
6-months follow-up			
Preoperative opioid use	3.63	1.11-11.93	.034
Perioperative OME >513	3.17	1.04-9.67	.024
Preoperative VAS Pain	1.32	1.04-1.67	.003
BMI >30	1.09	1.01-1.17	.018
1-year follow-up			
Perioperative OME >513	3.34	1.01-11.03	.048

BMI, body mass index; CI, confidence interval; OME, oral morphine equivalent; VAS, visual analog scale.

Table 4. Preoperative and Postoperative Patient-Reported Outcome Scores at 1 Year

	N-OU			OU			
All Patients	Preoperative	Postoperative	Δ	Preoperative	Postoperative	Δ	*P* Value Δ
IKDC	50.47 ± 17.48	78.01 ± 17.83	25.89 ± 21.34	39.46 ± 16.96	60.08 ± 22.05	44.83 ± 13.32	.454
KOOS JR	66.51 ± 16.77	82.37 ± 14.62	17.27 ± 14.36	56.16 ± 15.99	75.72 ± 20.74	29.18 ± 3.73	.271
KOOS Pain	67.75 ± 18.93	84.86 ± 14.08	22.66 ± 18.04	53.29 ± 20.64	71.08 ± 21.29	32.94 ± 20.94	.192
KOOS Sx	65.78 ± 19.35	80.80 ± 16.44	20.09 ± 19.64	51.85 ± 16.50	68.07 ± 19.74	29.08 ± 13.27	.258
KOOS ADL	77.66 ± 20.08	92.45 ± 12.41	21.54 ± 19.19	59.97 ± 26.13	79.14 ± 18.29	19.17 ± 15.79	.91
KOOS QoL	29.78 ± 21.12	64.03 ± 25.16	39.79 ± 27.97	17.82 ± 17.31	46.09 ± 34.22	37.50 ± 23.39	.842
KOOS Sport	37.52 ± 26.43	72.66 ± 24.46	47.33 ± 31.01	21.48 ± 22.18	51.25 ± 35.61	37.14 ± 22.33	.419
KOOS PS	33.17 ± 15.38	19.03 ± 17.31	−14.14 ± 16.33	43.56 ± 18.28	36.85 ± 10.11	−6.71 ± 9.83	**.019**

NOTE. Boldface indicates statistical significance.

ADL, activity of daily living IKDC, International Knee Documentation Committee; JR, Joint Replacement; KOOS, Knee Injury and Osteoarthritis Outcome Score; N-OU, opioid-naïve; OU, opioid user; PS, physical symptoms; QoL, quality of life; Sx, symptoms.

surgery.[22] Our results are similar: patients with preoperative opioid use are 3.63 times more likely to continue taking opioids at 6 months postoperatively. In addition, we found that patients who consume in excess of 513 OME of opioids, which equates to 342 mg of oxycodone or 513 mg of hydrocodone (approximately 68-5 mg pills of oxycodone, 51-10 mg pills of hydrocodone) during the perioperative period are 3.17 and 3.34 times more likely to continue consuming opioids at 6 and 12 months postoperatively, respectively.

In addition, we found that patients with greater preoperative VAS pain scores, specifically with a threshold of 62.6 on AUC, were more likely to be using opioids at 6 months. These findings suggest that surgeons should take care in identifying those patients with preoperative opioid use and may consider calculating patients' perioperative opioid requirement, as those who require more than 513 OME may benefit from being more closely monitored for and counseled regarding prolonged opioid use.

Several studies have evaluated the relationship between preoperative opioid use and outcomes following various orthopaedic procedures, and the majority have shown concerning trends toward inferior outcomes. Sabesan et al.[16] found that preoperative opioid use was associated with significantly lower postoperative patient reported outcomes and greater postoperative pain scores in patients undergoing arthroscopic rotator cuff repair. In studying patients undergoing reverse total shoulder arthroplasty, Morris et al.[14] demonstrated that those with preoperative opioid use had lower preoperative baseline scores and did not achieve the same peak outcome scores as patients without a history of preoperative opioid use. This investigation found the same to be true in the context of ACLR. In addition, Zywiel et al.[15] concluded that patients who use opioids before total knee arthroplasty may be at substantially

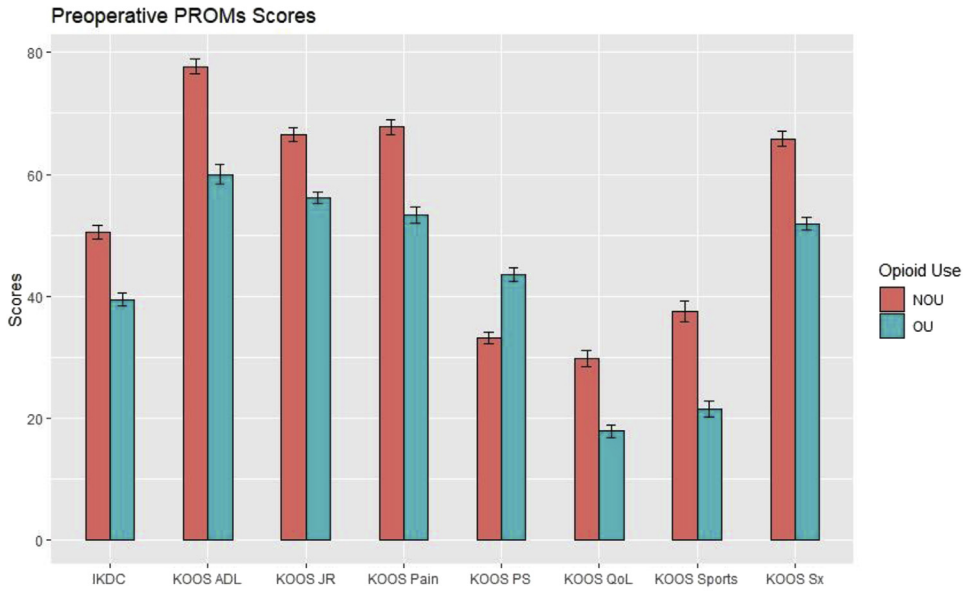

Fig 1. Comparison of baseline PROM scores, all comparisons by Mann−Whitney *U* test were significant with $P < .001$. (ADL, activities of daily living; JR, Joint Replacement; IKDC, International Knee Documentation Committee; KOOS, Knee Injury and Osteoarthritis Outcome Score; N-OU, opioid-naïve; OU, opioid use; QoL, quality of life; PROM, patient-reported outcome measure; PS, physical symptoms; Sx, symptoms.)

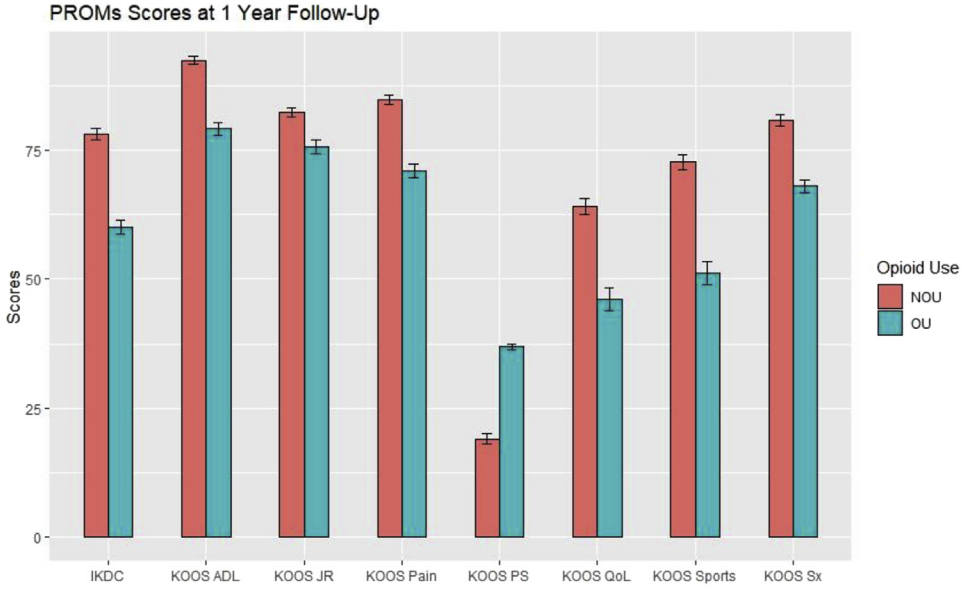

Fig 2. Comparison of postoperative PROM scores following ACLR, all comparisons by Mann−Whitney *U* test were significant with $P < .001$ with the exception of the KOOS JR ($P = .165$). (ACLR, anterior cruciate ligament reconstruction; ADL, activities of daily living; JR, Joint Replacement; IKDC, International Knee Documentation Committee; KOOS, Knee Injury and Osteoarthritis Outcome Score; N-OU, opioid-naïve; OU, opioid use; QoL, quality of life; PROM, patient-reported outcome measure; PS, physical symptoms; Sx, symptoms.)

greater risk for complications and painful, prolonged recoveries.

The results of the present study demonstrate a consistent trend in the context of ACLR. Preoperative opioid users were significantly less likely to achieve PASS on measures of function in sport and recreation ($P = .02$), pain ($P = .02$), symptoms ($P = .03$), knee-related quality of life ($P = .005$), and activities of daily living ($P = .008$). Collectively, data from this study and previous studies on the topic could improve preoperative counseling to patients already taking opioids and establish appropriate patient, family, and surgeon expectations. Surgeons may consider paying special attention to patients who have used opioids preoperatively and focus on ensuring that alternative means of pain management, including physical therapy, nonopioid medications such as acetaminophen or ibuprofen, cognitive behavioral therapy when appropriate, and exercise, are available.

Patients who made up this study cohort were prescribed 30 pills of 5mg hydrocodone-325 mg acetaminophen, which in some instances was increased to 60 pills if patients demonstrated an increased demand for postoperative pain control. As more surgeons move toward limiting the role of prescription opioids, or opting for opioid-sparing postoperative pain management, further investigation is necessary to determine whether discontinuing opioid use in anticipation for ACLR or limiting

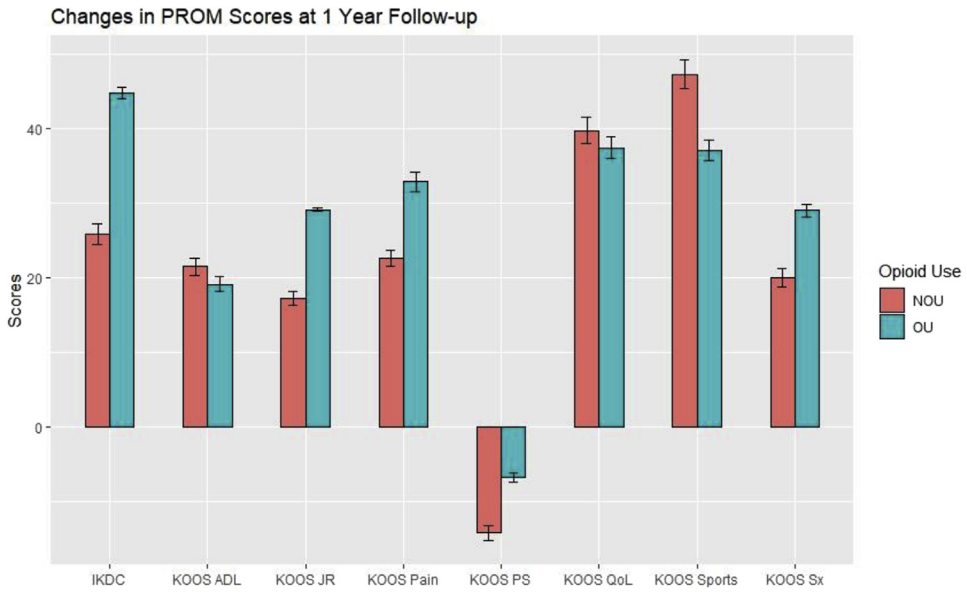

Fig 3. Comparison of change in PROM scores following ACLR. * denotes significance on Mann−Whitney *U* test with $P < .05$. (ACLR, anterior cruciate ligament reconstruction; ADL, activities of daily living; JR, Joint Replacement; IKDC, International Knee Documentation Committee; KOOS, Knee Injury and Osteoarthritis Outcome Score; N-OU, opioid-naïve; OU, opioid use; QoL, quality of life; PROM, patient-reported outcome measure; PS, physical symptoms; Sx, symptoms.)

Table 5. Breakdown of PASS Rates by Preoperative Opioid Use

	Percentage Within Each Cohort		
	N-OU	OU	P Value
IKDC	40%	18%	**.007**
KOOS JR	46%	18%	**.004**
KOOS Pain	41%	18%	**.016**
KOOS Sx	52%	25%	**.008**
KOOS ADL	52%	25%	**.008**
KOOS QoL	55%	21%	**.001**
KOOS Sport	54%	18%	**<.001**

NOTE. Boldface indicates statistical significance.

ADL, activity of daily living; IKDC, International Knee Documentation Committee; JR, Joint Replacement; KOOS, Knee Injury and Osteoarthritis Outcome Score; N-OU, opioid-naïve; OU, opioid user; PASS, patient acceptable symptomatic state; QoL, quality of life; Sx, symptoms.

exposure in the perioperative period is an effective means of mitigating inferior postoperative outcomes.

Limitations

We acknowledge several limitations to the present study. First, given the retrospective design, we relied on the accuracy of electronic medical records. For this reason, the Illinois Prescription Drug Monitoring Database was used to cross reference the prescriptions and dosages. Second, the study design did not make it possible to accurately identify and control for the influence of potential risk factors such as type of anesthesia use, poor patient tolerance of nonopioid analgesics, history of addiction, and differences in social situation or occupation. Third, although this study is limited by a small OU cohort, a post-hoc power analysis revealed that our sample size of 253 was more than adequate to power the linear regression models. In addition, whereas there were significant differences between OU and N-OU cohorts with respect to smoking and age, these differences were eliminated following propensity score adjustment. Finally, although we were able to calculate the number of opioids prescribed to a patient, we were unable to assess the exact number of pills consumed. It is possible that patients were concealing opioid use or diverting opioids to other individuals, which may not accurately reflect postoperative opiate consumption. This limitation was addressed by confirming opioid prescription in two separate data sources. Furthermore, previous investigations have found that it is unlikely that patients do not take at least the minimum doses reported.[15]

Table 6. PASS Achievement in Preoperative Opioid Users Compared With Nonopioid Users at 1-Year Follow-Up

	Odds Ratio (95% CI)	*P* Value $_{Univariate}$	*P* Value $_{Multivariate}$
PASS IKDC	0.27 (0.1-0.74)	**.01**	.05
PASS KOOS Sport	0.25 (0.09-0.69)	**.007**	**.02**
PASS KOOS JR	0.31 (0.11-0.84)	**.02**	**.04**
PASS KOOS Pain	0.31 (0.13-0.77)	**.01**	**.02**
PASS KOOS Symptoms	0.32 (0.14-0.69)	**.01**	**.03**
PASS KOOS QoL	0.56 (0.13-2.51)	.45	**.005**
PASS KOOS ADL	0.23 (0.09-0.58)	**.002**	**.008**

NOTE. Boldface indicates statistical significance.

ADL, activity of daily living; IKDC, International Knee Documentation Committee; JR, Joint Replacement; KOOS, Knee Injury and Osteoarthritis Outcome Score; PASS, patient acceptable symptomatic state.

Conclusions

Preoperative opioid use, BMI >30, and greater VAS pain scores were predictors of continued opioid use at 6 months postoperatively. Preoperative opioid users were more likely to continue taking opioids, demonstrate significantly worse patient-reported outcomes at baseline and 1-year postoperatively, and were less likely to achieve PASS.

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Appendix

Appendix Table 1. Calculated CSO Thresholds for PROMs Investigated

PROM	MCID	SCB	PASS
IKDC	18.9	29.6	75
KOOS JR	8.87	13.4	76.3
KOOS Pain	11.93	15.48	80.56
KOOS PS	−14.85	−29.82	18.63
KOOS Symptom	15.73	25.31	78.57
KOOS ADL	13.34	19.87	92.28
KOOS Sport	27.02	43.03	70
KOOS QoL	25.87	35.79	50

CSO, clinically significant outcome; IKDC, International Knee Documentation Committee; JR, Joint Replacement; KOOS, Knee Injury and Osteoarthritis Outcome Score; MCID: minimal clinically important difference; PASS, patient acceptable symptomatic state; PROM, patient-reported outcome measure; PS, physical symptoms; QoL, quality of life; SCB, substantial clinical benefit.