Original Article

Prescribing Fewer Opioids After Rotator Cuff Repair and Anterior Cruciate Ligament Reconstruction Lowers Opioid Consumption Without Impacting Patient-Reported Pain Scores

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Purpose: To develop a standardized opioid prescribing schedule (SOPS) following anterior cruciate ligament reconstruction (ACLR) and rotator cuff repair (RCR) and evaluate postoperative opioid consumption alongside Patient-Reported Outcome Measurement Information System (PROMIS) pain interference scores. **Methods:** A prospective observational study was performed on all patients undergoing primary ACLR and RCR from March 2019 to October 2021. Patients taking opioids preoperatively and revision ACLR and RCR were excluded. PROMIS 6B questionnaires were administered before and after implantation of the SOPS initiated on December 15, 2019. Opioid consumption was determined by email surveys. Hypothesis testing was performed with Mann–Whitney U test. **Results:** A total of 599 patients met inclusion criteria with 188 patients (71 ACLR and 117 RCR) completing surveys. Before the initiation of SOPS, the average number of oxycodone 5-mg tablets prescribed for ACLR was 44.6 (95% confidence interval [CI] 42.4-46.9) and for RCR was 44.7 (95% CI 42.7-46.8). The average usage was 23.1 (95% CI 16.9-29.2) and 22.1 (95% CI 16.2-28.0), respectively. Following SOPS of 30 tablets of oxycodone 5 mg for ACLR and 40 tablets for RCR, the average number of tablets prescribed significantly decreased for both procedures ($P < .01$ for ACLR and RCR), and the average consumption decreased to 20.5 (95% CI 16.6-24.4) and 18.6 (95% CI 14.6-22.5), respectively. PROMIS 6B responses did not demonstrate statistically significant changes following SOPS. **Conclusions:** The results of the present study demonstrate that the implementation of a SOPS reduced postoperative opioid prescribing amounts and consumption without significant impacting PROMIS pain interference scores for ACLR and RCR, supporting the possibility to decrease and standardize opioid prescribing following common sports medicine procedures. **Level of Evidence:** III: Retrospective, comparative, therapeutic study.

Postoperative opioid prescribing continues to attract attention at a national level in the United States, with an estimated 80% of the global opioid supply consumed annually.[1] The field of orthopaedic surgery is among the top 5 specialties for opioid prescribing and one of the largest medical providers of postoperative narcotics.[2,3] Preoperative opioid consumption has been shown to increase postoperative opioid usage, and even in opioid-naïve patients, postoperative consumption can lead to long-term use.[4,5] To combat postoperative opioid prescribing and limit detrimental postoperative side effects of opioid consumption, many states have passed legislation limiting the amount of postoperative pain medications prescribed after surgery.[6] To further standardize prescribing patterns, Lovecchio et al.[3] published a review article on opioid-prescribing practices for many common orthopaedic surgeries.

Previous studies have assessed the impact of a standard opioid prescribing schedule (SOPS) on postsurgical opioid consumption in orthopaedics, including standardized prescribing following anterior cruciate

ligament reconstruction (ACLR) and rotator cuff repair (RCR).[7] Additional literature published has advocated the use of multimodal protocols to eliminate post-operative opioids.[8] To date, there is limited literature looking at the impact of SOPS on the Patient-Reported Outcome Measurement Information System (PROMIS) pain interference scores. The PROMIS score is a validated algorithm developed by the National Institutes of Health to improve patient-reported outcomes measurements in pain by tracking and assessing patient outcomes and is becoming increasingly popular with the shift to outcome-based reimbursement. The PROMIS 6B short form is a validated measure of pain interference in daily activities that assesses pain interference in 6 aspects of livelihood: enjoyment of life, ability to concentrate, performance in day-to-day activities, enjoyment of recreational activities, participating in tasks away from home such as running errands, and socializing with others.[9] The PROMIS 6B short form has been used in previous orthopaedic studies.[10,11] The PROMIS 6B short form is graded from 1 (not at all) to 5 (very much).

The purposes of this study were to develop a SOPS following ACLR and RCR and evaluate postoperative opioid consumption alongside PROMIS pain interference scores. We hypothesized that reducing opioid prescribing would reduce consumption without negatively impacting PROMIS scores.

Methods

Institutional review board approval was obtained before initiation of this study by our institution's approval board (approval number 17-1054). We performed a retrospective analysis of prospectively collected data on consecutive patients undergoing primary ACLR and RCR (identified by Current Procedural Terminology codes 29888 and 29827, respectively) at our high-volume academic tertiary referral center with 3 sport medicine fellowship-trained senior surgeons. Inclusion criteria included all patients undergoing an elective RCR or ACLR, provision of written informed consent, male or female aged 16 to 80 years, and able and willing to comply with all study requirements. Patients taking opioids preoperatively or with a previous history of drug abuse, as well as patients undergoing revision surgery, were excluded. Patients were consented in the study when they received the 2-week postoperative electronic survey.

Pre-SOPS data were collected from March 2019 to December 2019. Prescriptions were provided to the patients on the day of surgery within the state legislation restricting postoperative opioid prescribing to a 7-day postoperative period. The average number of 5-mg oxycodone tablets prescribed for ACLR was 44.6 (95% confidence interval [CI] 42.7-46.9) and for RCR was 44.7 (95% CI 42.7-46.8). The average number 5-mg oxycodone tablets consumed for ACLR was 23.1 (95% CI 16.9-29.2) and for RCR was 22.1 (95% CI 16.2-28.0). Using the data, a SOPS was agreed upon by the 3 senior surgeons: 30 tablets of oxycodone 5 mg for ACLR and 40 tablets of oxycodone 5 mg for RCR. Also included in the postoperative multimodal pain control program was Tylenol 1000 mg every 8 hours for 14 days, gabapentin 100 mg 3 times daily for 5 days, and
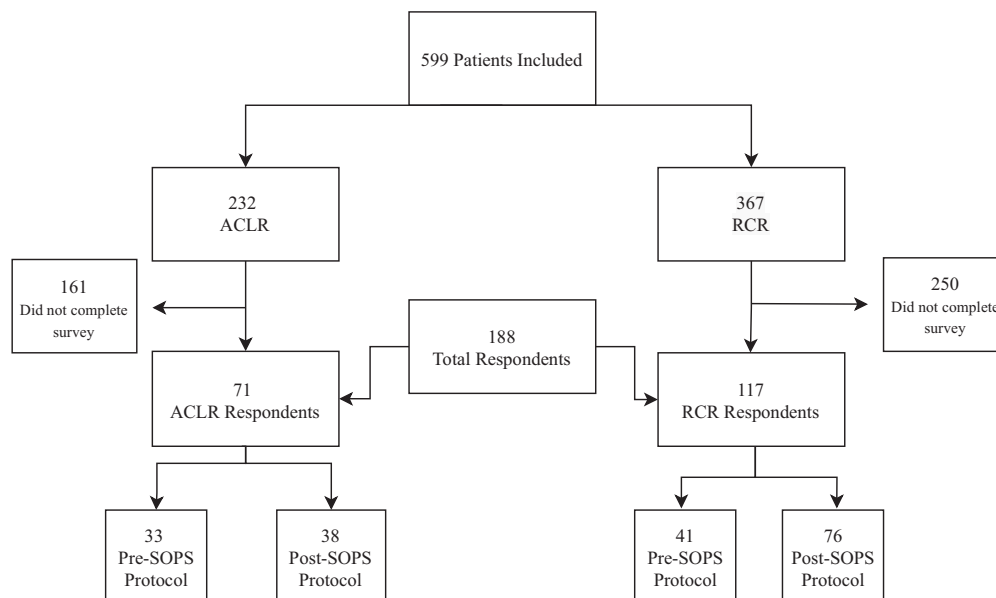

Fig 1. Consolidated Standards of Reporting Trials (CONSORT) diagram. The CONSORT diagram showing those patients who were included in, enrolled in, and completed the surveys for each procedure. (ACLR, anterior cruciate ligament reconstruction; RCR, rotator cuff repair; SOPS, standardized opioid prescribing schedule.)
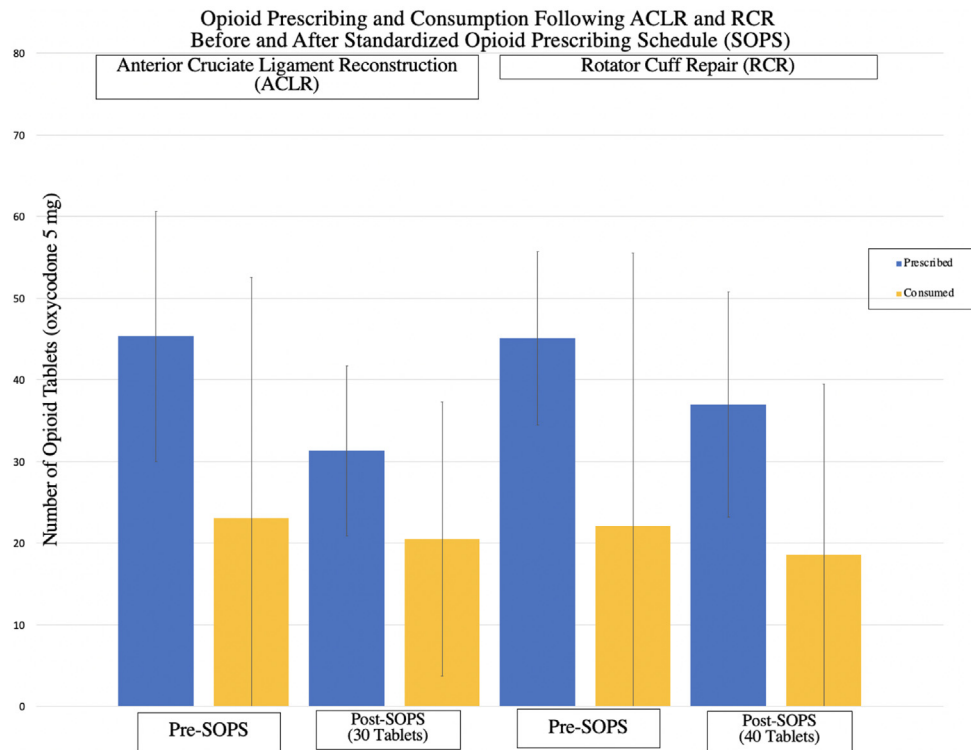
Fig 2. Opioid prescription and consumption after ACLR and RCR Pre-SOPS and Post-SOPS. This graph shows the number of oxycodone tablets prescribed and consumed postoperatively as reported by patients 2 weeks following discharge along with error bars representing 1 standard deviation from the mean. (ACLR, anterior cruciate ligament reconstruction; RCR, rotator cuff repair; SOPS, standardized opioid prescribing schedule.)

patients were discharged with an ice therapy machine. The SOPS was implemented in December 2019 and continued for the remainder of the study.

Patients were contacted 2 weeks' postoperatively via an electronic survey. If the survey was not completed, an automated second and third email would be sent stating that the survey had not been completed. Patients would not receive more than 3 emails. Results of the patient-reported survey were stored within a secure database. The survey assessed postoperative opioid consumption and the PROMIS 6B pain interference short form.

Descriptive statistics (mean and the 95% CI of the mean) of the data distribution of the study sample were summarized. Normality of distribution was assessed using Q-Q plots and Shapiro–Wilk test, the results of which indicated that the assumption of normal distribution was not met. Thus, Mann–Whitney U test was performed for hypothesis testing. Post hoc analysis was performed to show how many subjects would be required to show a difference between groups. A P value of less than .05 was considered significant for statistical tests. All statistical analyses were performed using SAS, version 9.4 (SAS Institute Inc., Cary, NC).

Results

A total of 599 patients met inclusion criteria, including 232 patients who underwent ACLR and 367 patients who underwent RCR (Fig 1). A total of 71 and 117 patients responded to the 2-week postoperative electronic survey respectively and as such were included in this study. During the study, adherence rate to the SOPS for ACLR was 82.7% and adherence rate to the SOPS for RCR was 91.2%, combining for 88.2% adherence to the SOPS protocol.

Anterior Cruciate Ligament Reconstruction

Of the 232 patients who underwent ACLR, a total of 71 patients responded to the 2-week postoperative electronic survey (response rate of 30.6%): 33 pre-SOPS protocol and 38 post-SOPS protocol. Following SOPS, the average number of oxycodone 5 mg tablets prescribed for ACLR was 31.3 (95% CI 30.3-32.4) ($P <$ .001). When compared with the number of tablets consumed pre-SOPS, 23.1 (95% CI 16.9-29.2), the average number of 5-mg oxycodone tablets consumed for ACLR was 20.5 (95% CI 16.6-24.4) ($P =$ .47) (Fig 2). PROMIS 6B scores did not demonstrate statistically significant change between the pre-SOPS and post-SOPS patients (Table 1). Post hoc power analysis

Table 1. PROMIS 6B Scores Following Pre-SOPS and Post-SOPS ACLR (Using Mann−Whitney U Test with 95% CI for Difference; $\alpha < 0.05$)

PROMIS 6B	Pre-SOPS	Post-SOPS (30 Tablets)	P Value
How much did pain interfere with your enjoyment of life?	3.17 ± 1.12	3.53 ± 1.18	.09
How much did pain interfere with your ability to concentrate?	2.60 ± 1.12	2.74 ± 1.33	.35
How much did pain interfere with your day-to-day activities?	3.54 ± 1.17	3.51 ± 1.18	.47
How much did your pain interfere with recreational activities?	3.74 ± 1.17	3.86 ± 1.30	.26
How much did pain interfere with doing your tasks away from home (e.g., getting groceries, running errands)?	3.80 ± 1.13	3.88 ± 1.35	.24
How often did pain keep you from socializing with others?	2.49 ± 1.07	2.78 ± 1.21	.15

NOTE. PROMIS 6B graded on a scale from 1 (not at all) to 5 (very much).

ACLR, anterior cruciate ligament reconstruction; CI, confidence interval; PROMIS, Patient-Reported Outcome Measurement Information System; SOPS, standardized opioid prescribing schedule.

showed that a 2-group t-test with a 5% 2-sided significance level will have 90% power to detect the difference between a Pre mean, μ_1, of 23.1 and a Post mean, μ_2, of 20.5 a difference in means of 2.6 assuming that the common standard deviation is 12, when the sample sizes in the two groups are 449 and 449, respectively (a total sample size of 898).

Rotator Cuff Repair

Of the 367 patients who underwent RCR, a total of 117 patients responded to the 2-week postoperative electronic survey (response rate of 31.9%): 41 pre-SOPS protocol and 76 post-SOPS protocol. Following SOPS, the average number of oxycodone 5-mg tablets prescribed for RCR was 37.0 (95% CI 36.2-37.8) ($P < .001$). When compared with the number of tablets consumed pre-SOPS, 22.1 (95% CI 16.2-28.0), the average number of 5-mg oxycodone tablets consumed for RCR was 18.6 (95% CI 14.6-22.5) ($P = .18$) (Fig 2). PROMIS 6B scores did not demonstrate statistically significant change between the pre-SOPS and post-SOPS patients (Table 2). Post hoc power analysis showed that a 2-group t-test with a 5% 2-sided significance level will have 90% power to detect the difference between a Pre mean, μ_1, of 22.1 and a Post mean, μ_2, of 18.6 a difference in means of 3.5 assuming that the common standard deviation is 18, when the sample

sizes in the 2 groups are 557 and 557, respectively (a total sample size of 1114).

Discussion

Creating and implementing a SOPS demonstrated a statistically significant decrease in opioid prescribing following ACLR and RCR and decreased the number of oxycodone tablets consumed without impacting PROMIS 6B scores reported 2 weeks postoperatively, confirming our hypothesis. These results corroborate studies performed within the total hip and knee arthroplasty literature.[10] Although studies have demonstrated the impact of prescription-limiting legislation, including in knee and shoulder arthroscopy, previous literature has not evaluated PROMIS.[12,13] Previous literature has emphasized the importance of limiting postoperative opioid prescribing and the associated inferior patient outcomes following ACLR.[14,15] Bisson et al.[16] found that regional guidelines effectively decreased postoperative narcotic prescribing without impacting patient satisfaction. As there is a push to limit postoperative opioid prescribing, standardizing opioid protocols, and maximize a multimodal approach to pain, this study further emphasizes that patient-reported pain is not impacted by decreased prescribing and encourages prescribers to develop

Table 2. PROMIS 6B Scores Following Pre-SOPS and Post-SOPS RCR (Using Mann−Whitney U Test With 95% CI for Difference; $\alpha < 0.05$)

PROMIS 6B	Pre-SOPS	Post-SOPS (40 Tablets)	P Value
How much did pain interfere with your enjoyment of life?	3.20 ± 1.33	3.02 ± 1.24	.23
How much did pain interfere with your ability to concentrate?	2.45 ± 1.05	2.43 ± 1.20	.41
How much did pain interfere with your day-to-day activities?	3.33 ± 1.14	3.14 ± 1.31	.19
How much did your pain interfere with recreational activities?	3.59 ± 1.22	3.57 ± 1.34	.48
How much did pain interfere with doing your tasks away from home (e.g., getting groceries, running errands)?	3.38 ± 1.21	3.24 ± 1.42	.33
How often did pain keep you from socializing with others?	2.61 ± 1.15	2.64 ± 1.20	.46

NOTE. PROMIS 6B graded on a scale from 1 (not at all) to 5 (very much).

ACLR, anterior cruciate ligament reconstruction; CI, confidence interval; PROMIS, Patient-Reported Outcome Measurement Information System; SOPS, standardized opioid prescribing schedule.

postoperative prescribing protocols. Although the number of tablets consumed did not reach statistical significance, the authors view the decreased total number of tablets consumed as being important by reducing the number of narcotics circulating in the general population. This study adds to the current literature by using PROMIS pain interference scores to determine whether a decrease in prescribing impacts patient-reported outcomes. Previous studies have defined that the minimally clinically important difference for PROMIS pain interference scale is 2 points.[17] The results of this study do not have a significant impact on PROMIS pain interference scores. It is interesting to note that despite being only 2 weeks out from RCR, patients reported a decrease in pain interference in enjoyment of life and with day-to-day activities, although neither reached statistical significance.

Limitations

Our study has several limitations. First, the surveys were completed by patients at the 2-week postoperative time point. This is still a difficult time for patients, and many of the PROMIS 6B questions reflect the expected postoperative course for both ACLR and RCR, with difficulties in performing day-to-day activities and enjoyment in life. However, the 2-week survey was intentionally chosen to capture narcotic usage in the acute postoperative period. Per state legislation, postoperative narcotic prescriptions can be written for a duration of 7 days. The follow-up period was 2 weeks after discharge, so patients should have completed narcotic consumption by this time period. This period could introduce recall bias. Future studies could limit this bias by asking patients to document the number of pills consumed. Participation bias also could be possible based upon those patients who decided to participate in the study. A second limitation is response rate. Combined, a total of 31.4% of patients responded to the survey (30.6% of ACLR and 31.9% for RCR). Although this response rate is comparable with other similar studies,[16,18,19] a large proportion of patients did not respond and could influence the true results. Similarly, the results may be susceptible to response bias. Third, the current study relies on self-reported opioid consumption and did not use substance-prescribing databases. Because our accountable care organization operates under a policy in which the orthopaedic surgeon is solely responsible for opioid prescription in the first 6 weeks postoperatively, it is unlikely the patients were obtaining additional prescriptions. Finally, we did not perform any statistical analysis on patient demographics, comorbidities, or other possible confounding factors. Baseline characteristics could have been beneficial to compare between the groups to ensure no other variable confounded narcotic consumption.

Conclusions

The results of the present study demonstrate that the implementation of a SOPS reduced postoperative opioid prescribing amounts and consumption without significant impacting PROMIS pain interference scores for ACLR and RCR, supporting the possibility to decrease and standardize opioid prescribing following common sports medicine procedures.

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